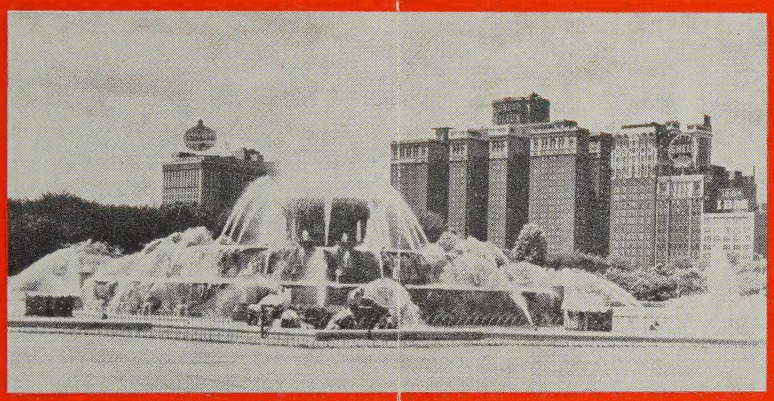
July 1960

Insulation



The place to be . . .
pages 4 and 30

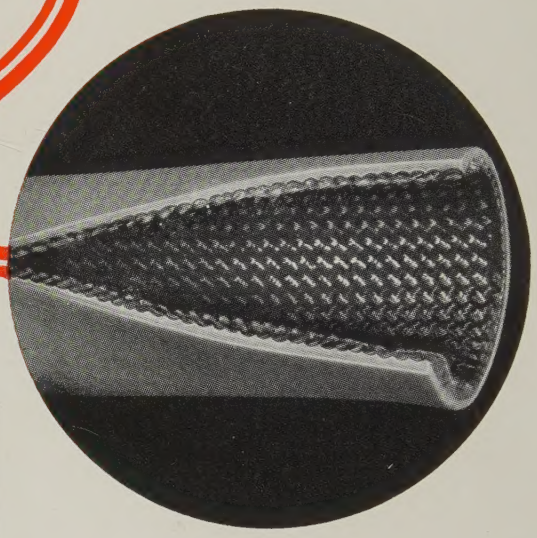
In this issue:

EXTRUSION

makes the difference i

BEN-HAR "1151"

SILICONE RUBBER FIBERGLASS SLEEVIN



The super-tough **durasyl** silicone rubber coating of Ben-Har "1151" is so tough and so effectively bonded to the supporting braid that breakdowns caused by pushback, abrasion or rough handling are eliminated. Applied by a new extrusion process, **durasyl** is so flexible that expansion up to a 400% increase of a.w.g. size is possible, minimizing tolerance problems.

Extrusion technique permits continuous electronic inspection, assuring absolute uniformity and unique outside diameter control, holding it to a maximum of ± .005 inches.

These are some of the superior advantages Ben-Har "1151" offers over conventionally dip-coated class H sleevings . . . send now for free testing samples and data sheet.

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INSULATION BUYERS CAN AFFORD TO RELAX

Men who buy electrical insulation materials from Prehler can afford to relax—because Prehler doesn't. Worry-free buyers wear pleased expressions, content with the realization that Prehler shoulders their problems. Rush deliveries, new materials to improve your product, properties to meet tough requirements, advice on insulation methods . . . these are but a few of the things that keep Prehler men on the go all day long.

Because Prehler men have spent years specializing in electrical insulation, they have the know-how and experience to come up with the right answers to your insulation problems. Huge warehouse stocks of nearly all types of insulation, convenient locations, and a practical, working knowledge of how insulation is used in your type of product are other reasons why you can relax when you make Prehler your insulation headquarters. Write or phone for more information, now.

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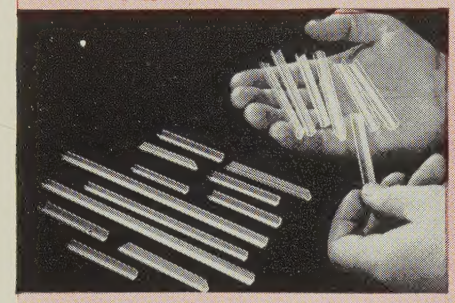
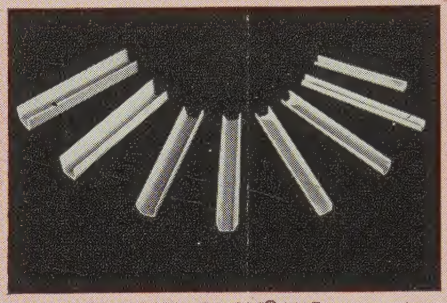
Only the Inmanco® family of WEDGES gives you so complete a selection of materials, shapes, sizes, and designs at so low a cost.

- Choose from stock wedges or wedges engineered to your exact specifications.
- Wedge materials for every requirement, including Mylar® polyester film, hard maple wood, fibre, canvas, asbestos, glass reinforced plastics, and others.
- INMANCO® wedges provide maximum properties for any specified wedging application.

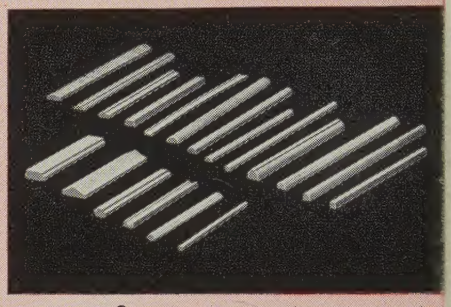
Close-up view showing Inmanco® curve-formed fibre wedge partially inserted in a motor stator. Square-formed fibre wedges are also in the INMANCO® wedge family.



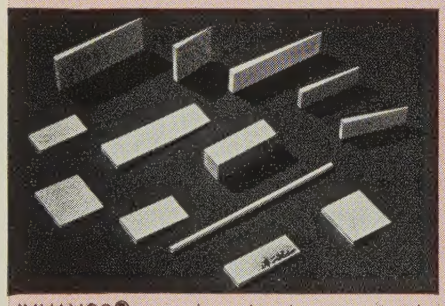
INMANCO-MYLAR® square-formed unsupported film wedges feature new and improved qualities —permanent, tough, space-saving thin wall, hollow shapes; high dielectric, thermal, and chemical resistance.



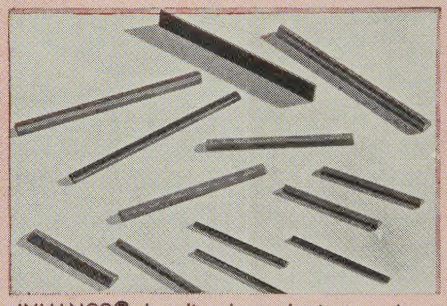
INMANCO LECTON-ORLON® MAT spacesaving, square-formed wedges for Class B temperature applications and hermetic motor wedging. Various sizes from either .015" or .028" materials.



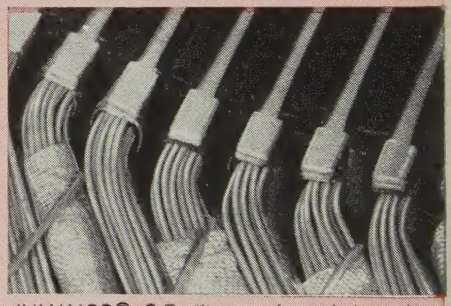
INMANCO® wood wedges of tough, straight grain, hard maple to resist breakage or splintering for lowest cost wedging. Widest variety of precision-molded shapes.



INMANCO® tapered wood wedges are uniquely made in a wide range of thicknesses, widths, and lengths, with any degree of taper.

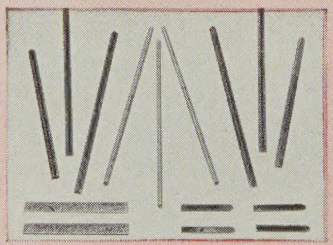


INMANCO® phenolic asbestos laminate wedges, precision-molded in a variety of solid shapes, are tough, resilient, and meet Class B temperature requirements.

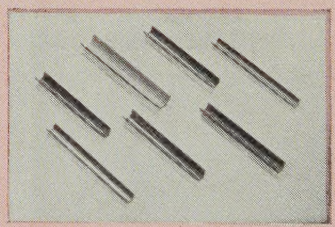


INMANCO® G-7 silicone glass cloth wedges which are machined to solid shapes combine maximum mechanical and dielectric properties for stable Class H wedging.

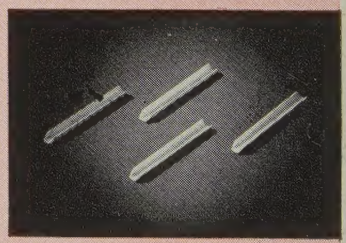
Write today for the Inmanco® Manual describing in detail the complete line of wedges. And, if you wish, request free samples.



INMANCO-HAYSITE® glass reinforced polyester wedges in a variety of solid shapes for tough, exacting wedging within Class A or B temperature ranges.



INMANCO-MYLAR® lined curve-formed fibre and square-formed rag paper wedges improve properties of fibre and paper for greater mechanical and dielectric strength, and moisture resistance.



INMANCO-CONOLITE® polyester laminate wedges designed for specific slot-size wedging.

Made by Inmanco® DIVISION

INSULATION MANUFACTURERS CORPORATION

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Insulation

For the Electrical and Electronic Industries

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From the Editor

Opinions and Rambling Thoughts

A Great Place to Be In December

That's the Conrad Hilton hotel in Chicago in the background. It will be the location of the Third National Conference on the Application of Electrical Insulation come December —the 5th through 8th of December to be specific. It isn't too early to start lending your support to a conference that will be held nearly six months from now—dozens of others have been doing just that for the past six months. And they have come up with plans for an outstanding technical conference. But to be successful, one more ingredient is needed—your active support.

How?

Well, if you manufacture insulation materials, wire, insulated components, test instruments, or processing equipment, you can make sure that your order for exhibit space has been entered. And you can start planning now to be sure that your exhibit booth is manned by technically competent men and that it offers a technically interesting display. What's more, to further facilitate arrangements, you can reserve the number of tables now that you will require for your guests at the conference banquet—this is not just the ordinary convention-type banquet—it is a significant, serious event of national stature.

And if you are a user of insulation materials, you can start now to obtain company-wide encouragement of maximum attendance at the conference. Tell your associates and friends throughout the industry about the value and importance of the conference. Register in advance to save yourself time and trouble and simplify the work of conference committee members.

On another page there are more complete details on conference features. Read about it . . . and lend your help now to those who have been trying to help you by supporting the conference all along.

The First 100 Are the Hardest

We were interested in the announcement by Norton Co. that it had successfully made diamonds—especially because the announcement just happened to fall in the company's diamond jubilee year, the 75th anniversary of its founding. Unfortunately, Webster's dictionary, our source of anniversary information, goes no further than 75 years so we don't know what material or product would be used to celebrate or signify a centennial anniversary. However, the materials selected for anniversaries falling in the first 75 years seem to grow more difficult to produce as the span of years increases. In view of this, we strongly but respectfully suggest that Norton Co. had better get busy now if the company is to come up with a suitable material for the 100th anniversary 25 years hence. Of course, the most common means of signifying a centennial year seems to be to grow beards and conduct suitable beard length or beard color contests—it would probably be a sufficiently remarkable feat for its 100th year if Norton could develop a means for moving the unnecessary facial growth to bare spots on top of the head.

Why Aluminum?

Copper producers and other metal firms will be delighted to learn that a new 28-story building in Oakland, Cal., uses more than 2,000,000 pounds of aluminum electrical and architectural products including 370 miles of aluminum wire and cable and 30 tons of aluminum conduit and bus bar. The news release which revealed this bit of information also reported that "aluminum's low cost, light weight and electrical properties have permitted an economical installation." We certainly do not wish to discredit such reasons for selecting aluminum but we strongly suspect that more basic motives might be involved—the building will house the headquarters of Kaiser Aluminum & Chemical Corp. and other Kaiser companies.

Our Nominee

To our way of thinking there are too many nominees for public office scurrying around the countryside telling us that they believe in more money for everyone, less work for everyone, and public assistance for old ladies concerned about safety when crossing streets.

If he ever comes along, we intend to vote for the man who is willing to proclaim:

1) that it is not sinful to make a profit,

2) that you, personally, pay for all welfare measures—it just costs you more when you let the government act as the middleman,

3) that it is a privilege to be an elected official and that elected officials are not privileged,

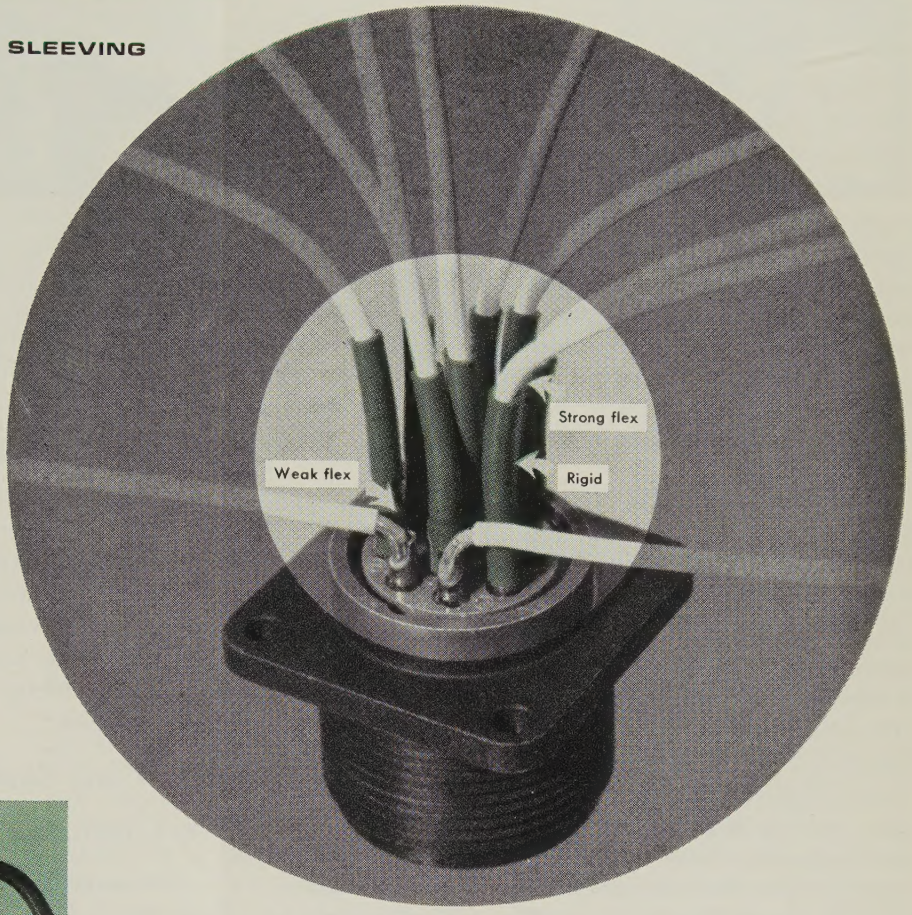
4) that public morality is a matter of the morality of each individual, and it's high time we started doing something about it,

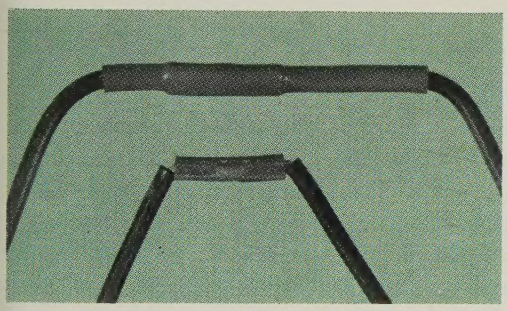
5) that even public officials are occasionally wrong, and it would be refreshing to hear them admit it.

NOW

THERMOFIT CRN

HIGH-STRENGTH • SEMI-RIGID SLEEVING





Flex point extended to insulation

CRN is a new irradiated Thermofit insulation sleeving designed for maximum mechanical strength at stress or connection points. As with other Thermofit products, the sleeving diameter may be reduced 50% upon the application of heat in excess of 275°F for a few seconds. It does not cold flow or melt and retains form stability at any temperature. It is available in eight standard color-coded sizes.

CRN

A NEW PLASTIC MEMORY PRODUCT OF

A SUBSIDIARY OF
RAYCHEM
CORPORATION

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News and Views

"Penton" Molding Compound Price Cut 30%

For the second time since its commercial introduction, Hercules Powder Co. has substantially cut the price of Penton chlorinated polyether molding compounds—this time by almost 30%. The new base price of natural Penton molding powder is $2.50 per pound as compared with the previous price of $3.50 per pound. Hercules hopes that the price reduction will greatly expand current markets. The company has also announced the availability of Penton in a new form—finely divided powders suitable for use in organic dispersions and other coating systems. These will now be offered in addition to the molding powder pellets supplied for conventional molding and extrusion.

Borden and U. S. Rubber To Jointly Build Chemical Plant

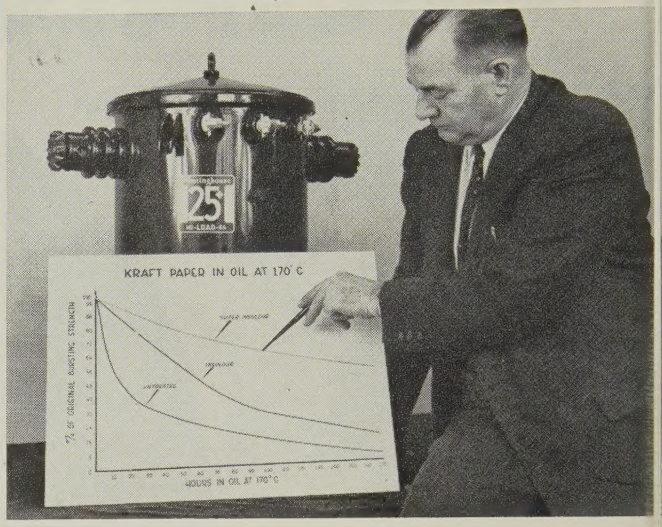
A program for the construction of a $50-million complex of chemical plants which would convert hydrocarbons into more than a dozen chemical products has been revealed by The Borden Co. and United States Rubber Co. The two companies are forming a jointly-owned chemical company to be called Monochem Inc., which will erect a major chemical manufacturing unit using hydrocarbons as a starting point for the production of acetylene and vinyl chloride monomer. Construction on the Monochem plant is expected to start later this year in either Louisiana or Texas. Initial capacity will be about 150-million pounds of vinyl chloride monomer annually.

Reinforced Plastics Company Purchased

Acquisition of Firmaline Products Inc., Midland Park, N.J., for an undisclosed amount of cash, has been announced by Crompton & Knowles Corp., Worcester, Mass. Firmaline, organized in 1954, manufactures reinforced plastics with principal markets in the electronics, electrical, aircraft, and other fields. Products include circuit breaker parts, battery boxes, radar parts, radomes, terminal board covers, cable supports, etc.

Improved Westinghouse Insulation Systems

An improved "Insuldur" insulation system, which reportedly permits higher operating temperatures without loss of transformer life expectancy, has been announced by Westinghouse Electric Corp. The new system is claimed to be twice as effective as the system it replaces and will allow temperatures as much as 30°C higher than untreated insulation and with the same life expectancy. The improved system is being used in all Westinghouse oil-immersed, 55°C distribution and power transformers. The



curve in the photograph shows the relationship of bursting strength of the improved system versus the previous system versus untreated insulation. For example, after 100 hours at 170°C, only 15% of the original bursting strength remains in untreated insulation, while the previous system is twice as good with 30% of the original strength remaining, and the improved system has 66% of its original strength.

Du Pont Starts Commercial Production Of Chemical for Epoxies, Cuts Price

Commercial production of pyromellitic acid (PMA) and pyromellitic dianhydride (PMDA), two new intermediate chemicals, has started at the Du Pont company's multi-million-pound-a-year unit at the Repauno Works, Gibbstown, N.J. Commercial scale production has made possible price reductions for PMA from $2.50 per pound to 85 cents a pound, and for PMDA from $3 a pound to $1 a pound. PMDA reportedly imparts outstanding thermal stability, electrical properties, and chemical resistance to epoxy resins. It can be used in the synthesis of high-temperature plasticizers, as a component of polyester and alkyd resins, and as an intermediate in the preparation of a variety of polymers. PMA can be used interchangeably in certain of these applications.

Polyurethane Resists Gamma Radiation

In a paper presented recently to the American Chemical Society, Dr. Charles S. Schollenberger of the B. F. Goodrich Chemical Co. has reported that his firm's Estane polyurethane material withstands the damaging effects of gamma radiation better than any known conventional elastomer. Since gamma radiation is present in the van Allen belt in outer space, it is conceivable that the material might be used advantageously in space applications as well as in nuclear installations. Wire and cable jacketing is expected to be a major potential use for the product.

In Hot, Humid Climates, Polyester Varnishes Help Prolong Equipment Life.

An interview with J. W. McHugh, Vice President
Schenectady Varnish Company, Inc., Schenectady, N. Y.

Polyester insulating varnishes are noted for their superior heat life compared to other organic varnishes. The following discussion describes another outstanding characteristic — moisture resistance — and its significance to the electrical engineer.

Q. In addition to their heat resistance, what other advantages do polyester varnishes offer electrical equipment manufacturers?

A. Speaking only about ISONEL® polyester varnishes made by our company, they have exceptional bond strength, excellent penetration and dip tank stability, and complete compatibility with most magnet wires. They are adaptable to automatic dipping equipment and high velocity ovens in fast cycles and have exceptional moisture resistance. They come close to being the long-sought "universal" varnishes.

Q. Moisture resistance is a characteristic which has received a good deal of attention recently. What evidence is available on the moisture resistance of polyester varnishes?

A. The exceptional moisture resistance of these varnishes was first noted in our laboratory, then confirmed in a government laboratory when they were tested against the MIL-V-1137A specification. Results showed:

1. Wet dielectric as high as 3030 vpm (compared to 1000 vpm or less for many widely used phenolic varnishes.)
2. Insulation resistance after 240 hours in water as high as 1.2 x 10^6 megohms.
3. The 100-hour salt water test was passed with plenty to spare.

In addition, independent laboratories have confirmed their superiority to most general-purpose, oil-modified phenolic varnishes now in use. Field experience has verified these results.

Q. Several tests in the MIL-V-1137A specification are water immersion tests. How do these varnishes stand up under high humidity conditions?

A. Very well. For example, one manufacturer of small transformers for military receivers used in the tropics cited extreme moisture resistance as one of his prime requisites. Exhaustive tests involving several hundred transformers and a number of insulating varnishes were conducted. The test units were all vacuum impregnated, cured for 2 hours at 325 F, then placed in a 96% R.H. atmosphere at 100 F. Their insulation resistance was measured daily for 7 days. At the end of the test, the units impregnated with ISONEL 31 Varnish averaged 1000 megohms compared to only 10 megohms or less for most of the other varnishes. Production units, therefore, were made with ISONEL varnish.

Q. What results have been obtained in actual field experience?

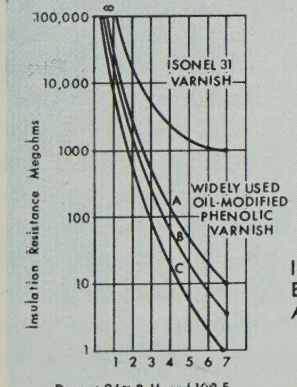
A. Some units have been exposed long enough now to answer this question. For example, one manufacturer producing motors for use in Gulf Coast oil refineries (subject to high humidity, chemically corrosive atmosphere) found these failed 6 weeks to 2 months after going into service. An ISONEL 31 Varnish/ ISONEL Enameled Wire* system was recommended. Motors so treated have now been running over 6 months — all through the hot, humid summer months — and are still going strong.

Q. Is this an isolated incident?

A. No. When the electrical system of the Panama Canal was converted from 25 to 60-cycle operation, a well-known manufacturer contracted to supply some 1100 motors, ranging from fractionals up to 700 hp. These not only had to operate at overloads when necessary, but must start up readily after standing idle for long periods under extreme humidity. Again, after extensive humidity chamber tests at 100% R.H. and 60 C, ISONEL impregnated stators showed the highest resistance to ground of any tested. An ISONEL varnish/polyester enameled wire system was used. To date (over 2 years later) no failures have occurred.

Q. What is the significance of this to electrical engineers?

A. Although field experience is still limited, it does seem apparent that engineers can use polyester varnishes to advantage over a much broader range of applications than any other organic varnishes. The steady increase in demand for polyesters also indicates their utility.



Insulation Resistance of ISONEL 31 High-Bonding Varnish vs. Phenolic Varnishes After 7 Days At 96% R.H. and 100 F.

* Consult your wire supplier for data on ISONEL enameled wire.

Inquiries should be directed to: Section E-102

In Canada: Schenectady Varnish Canada, Ltd. 309 Comstock Road Scarborough, Toronto, Ont.

In Mexico: Schenectady Varnish de Mexico, S.A. M. Antonio Casa No. 28 1er Mexico 4, D.F.

In France: Schenectady de France 11, Avenue Kleber Paris 16e

SCHENECTADY VARNISH COMPANY, INC.

SCHENECTADY 1, N. Y.

Insulating Varnishes and Wire Enamels for the Electrical Industry

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Plastic Insulates Computer Cable

Four of the most powerful transistorized electronic computers ever developed, capable of simultaneously reading and writing 3,000,000 units of information a second, have been developed and manufactured by International Business Machines Corporation for use in the Air Force's Ballistic Missile Early Warning System.

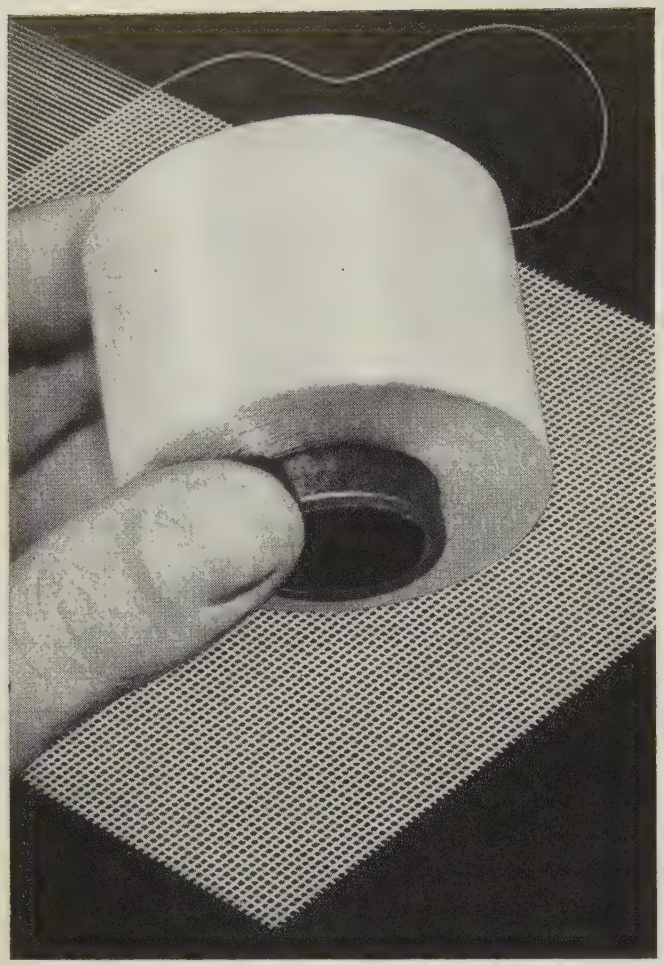
Computing speed is more than six times faster than that of vacuum-tube predecessors. This increase in performance is made possible by the use of thousands of ultra-fast transistors within the central processing unit of the computer, each apparatus utilizing nearly a quarter of a mile of "air-spaced" turbo ribbon cable insulated with Du Pont's "Rulan" flame-retardant plastics to connect internal circuits.

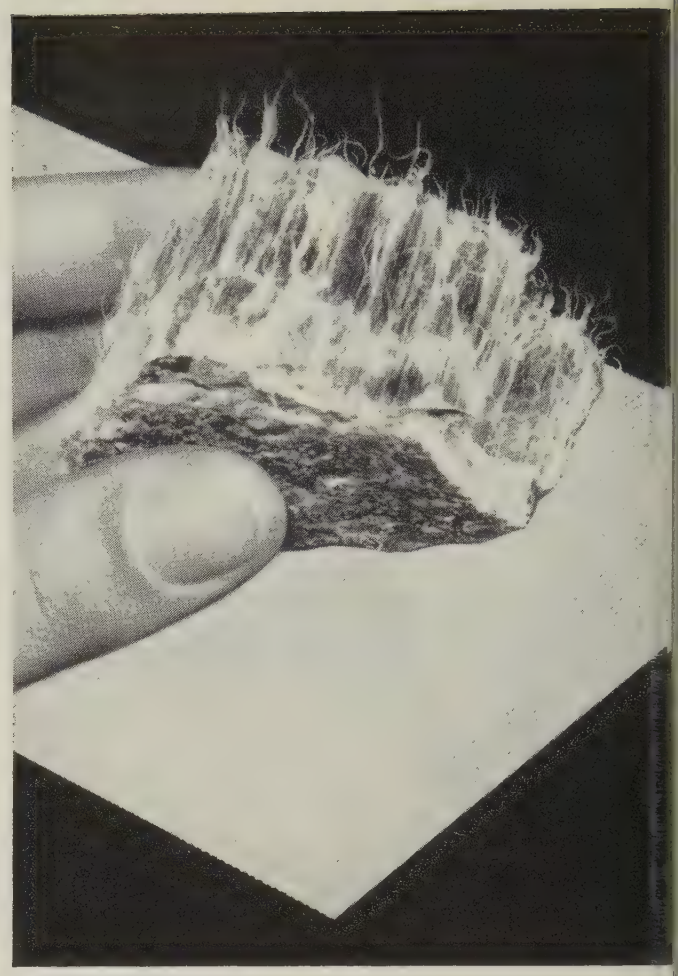
The standard modular system cable (developed and supplied by William Brand-Rex Div., American Enka Corp., Concord, Mass.) reportedly provides advantages in size, flexibility, and radius of bend.

The coaxial cable consists of 16 wire conductors, separately insulated before being fastened together. Dry air is the prime insulator, sealed in the spaces between an open spiral wrapping of monofil made of Rulan and a coating of Rulan extruded over the monofil.

Improved Analyses of Chemical Standards

A coulometric analytical method and a coulometric-titration coulometer —each providing a precision of 1 part in 100,000 for analyzing and evaluating chemical standards—have been developed by the National Bureau of Standards. Coulometric analyses are said to be simpler, quicker, and easier to perform than many of the corresponding gravimetric and volumetric determinations. Coulometric titration is based on the exact relationship between the amount of electricity used in an electrolysis and the amount of chemical reaction produced.





A glass yarn "skeleton"...with an asbestos "skin"

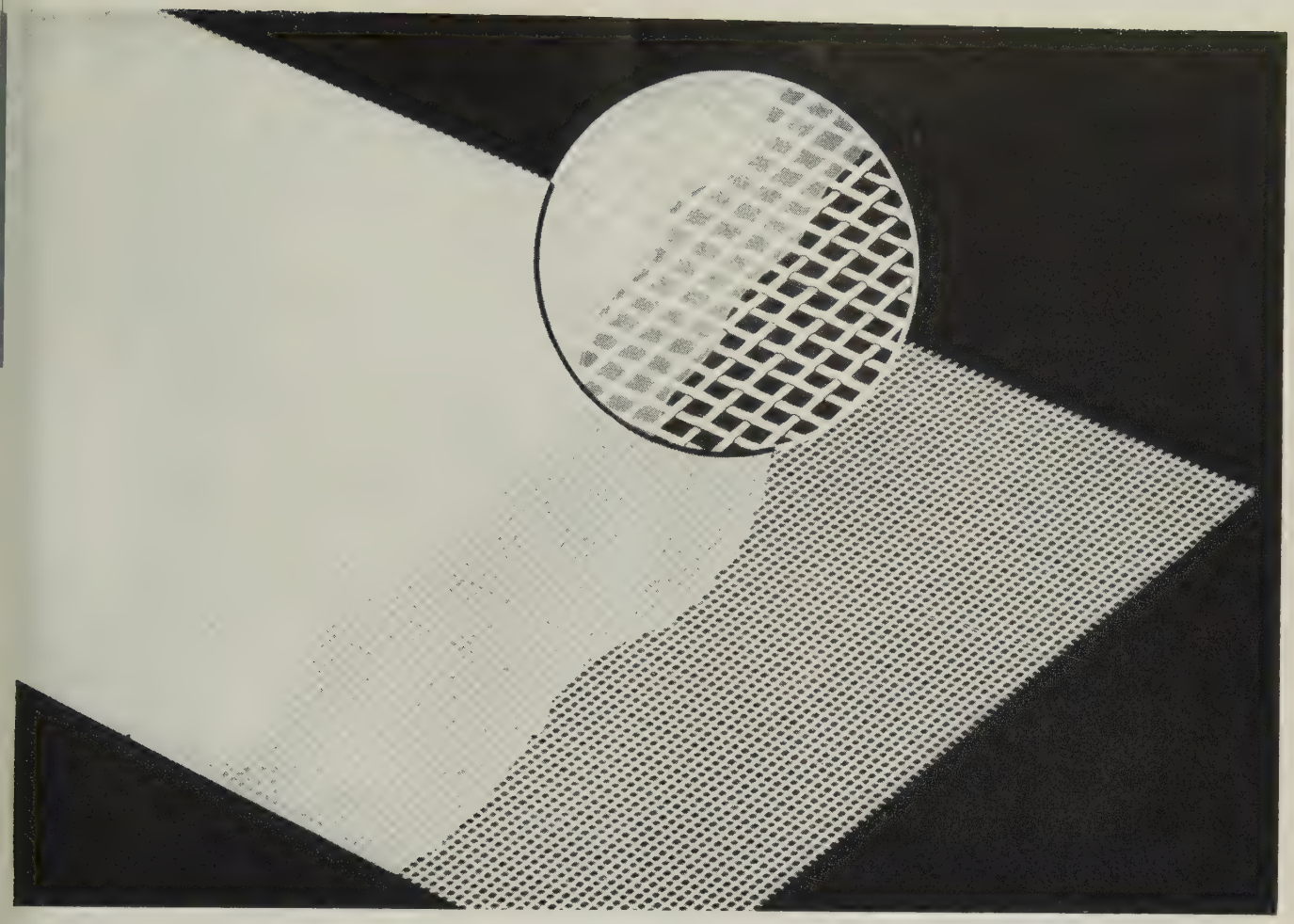
With new Quinorgo R-4...you get high mechanical strength and lasting dielectric properties in one sheet

For the first time...
J-M Fiber Glass Yarn
and J-M Asbestos Fiber
are integrally combined
in a single insulation

Need an insulation paper with the excellent handleability that results from high mechanical strength?

Because L·O·F Glass Fibers Company has joined the Johns-Manville family, you can now get excellent handleability along with good lasting electrical properties in new J-M Quinorgo® R-4.

An open cloth of tough Vitron fiber glass yarn—the same uniform, low-twist yarn widely used for efficient magnet wire production—provides great strength in both



...now gives you 2-ways-better insulation

machine and cross-machine directions. Prevents tearing, penetration; gives improved handleability for today's high-speed fabrication techniques. The glass fibers resist moisture . . . won't shrink or swell . . . and they withstand temperatures up to 1000 F.

Need dielectric properties that stand up under high operating temperatures?

You get lasting dielectric strength in new Quinorgo R-4. Highly purified asbestos fiber —formed integrally with the glass yarn as part of the papermaking process—retains its electrical properties under high-sustained operating temperatures. The asbestos has near-unlimited thermal resistance, too.

Quinorgo R-4 is currently supplied in 10-mil caliper for rotating equipment. For this or other electrical insulation needs, contact your nearby Johns-Manville representative. In addition to Quinorgo R-4, he can supply a wide range of asbestos-based insulations treated with Class B, F, or H resins. Send for helpful data sheets. Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ontario.

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JOHNS-MANVILLE JM PRODUCTS

Insulation Forum

This regular monthly feature is built around a timely question concerning the electrical insulation field. Your suggestions for future questions and participation are invited. This month's question is:

What do you predict will happen to business conditions in the electrical/electronic field during the rest of this year . . . and next year?

S. L. Bass

Vice President, Dow Corning Corp., Midland, Mich.

"Before predicting business conditions for the next 18 months, I would like to point out that we view the business patterns for the electronic market quite apart from those of the electrical power equipment market.

"For example, the electrical power equipment industry appears to be experiencing a fall-off in new orders. While equipment production schedules have not been affected because of substantial backlogs, as a material supplier, we find manufacturers are exercising closer inventory control than a year ago. We believe this inventory reduction is about completed. The third quarter of 1960 will show improvements in orders and production. The fourth quarter will show even further improvement.

"We anticipate that the need for silicone insulating materials in motors, transformers, and other industrial equipment will continue to grow at approximately twice the traditional rate of the electrical power industry during the next 18 months and the ensuing years.

"In the electronic industry, the growth rate appears substantially more rapid. Since military electronics is a large percentage of the total market, we find the electronic market influenced less by fluctuations in industrial economic conditions. Because of military requirements emphasizing reliability and miniaturization, the future of silicone materials looks extremely good. We anticipate growth in the last half of 1960 and all of 1961 to be at a rate greater than that for the power equipment field."

J. Loveland

Director of Purchases, Reda Pump Co., Bartlesville, Okla.

"Following the growth curve of the electrical/electronic field for the past few years, it seems it has increased at the rate of about doubling every 10 years.

"New and widespread demands in air conditioning, electrical heating, electronic computing equipment, plus research and development, and improved products in the electrical field will generate a bright growth for the future.

"The heating up of the cold war will undoubtedly give a considerable boost to the purchasing of electronic equipment for missiles, warning systems, and space exploration during the next few years.

"The consensus of the National Electrical Manufacturers Assn., which comprises about 95% of the electrical industry, is an expectation of a 5% increase in business for 1960 over 1959.

"With the coming of nuclear generated power and its impact on all phases of the electrical/electronic industry, barring unforeseen major swings in our country's economy.

(*Continued on page 14*)

a new FORMVAR based wire enamel for greatest reliability in hermetic units

Newly developed in Shawinigan Resins' laboratories is a totally new magnet wire insulating enamel which offers outstanding resistance to Refrigerant 22. Based on the well known FORMVAR resin, the new formulation is specifically designed for faultless performance in all Class A motors, particularly hermetic units using the newest refrigerants. It offers exceptional resistance to blistering, thermoplastic flow and hydrolysis, *plus* all of the ruggedness and efficiency of standard FORMVAR-with-phenolic insulations.

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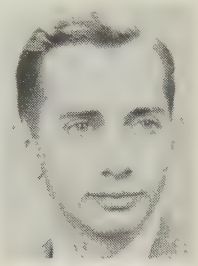
growth should continue through this and next year and, I predict, will more than double in the 'Sixties'."



S. Stryffeler

President, Red Seal Electric Co., Cleveland, Ohio.

"In our field of low voltage power distribution insulation, we predict that the second half of 1960 and 1961 will have higher levels of business activity. The emphasis on programmed and direct computer controlled automated production lines to overcome higher and undetermined labor factors, together with modernization of marginal facilities, create a growing demand for electrical energy for power and control. The heavy industrials have already initiated expansion programs based on this emphasis which will last into 1962 and should account for higher levels of activity."

E. Evancich

President, Wirekraft Inc., Rolling Prairie, Ind.

"The electrical/electronic industry is growing at a faster rate than industries in general. The basic part of the electrical industry is the utilities that supply electrical energy, and they are doubling their capacity every 10 years. This would lead one to believe that the average growth of our industry is a 10% increase per year, with variation caused by changes in social and economic conditions.

"Because of the recent increased tension in the cold war and as this is an election year, I predict a steady 10% growth in electrical/electronic industries during the rest of this year and next year, with increased price competition in our industry, especially from foreign sources."

Ultrasonic Testing Of Laminates

A new ultrasonic system capable of detecting minute voids and delaminations is now being used to inspect laminates manufactured by The Glastic Corp., Cleveland. Such sensitivity is important in assuring insulating material that will resist corona attack in high voltage applications.

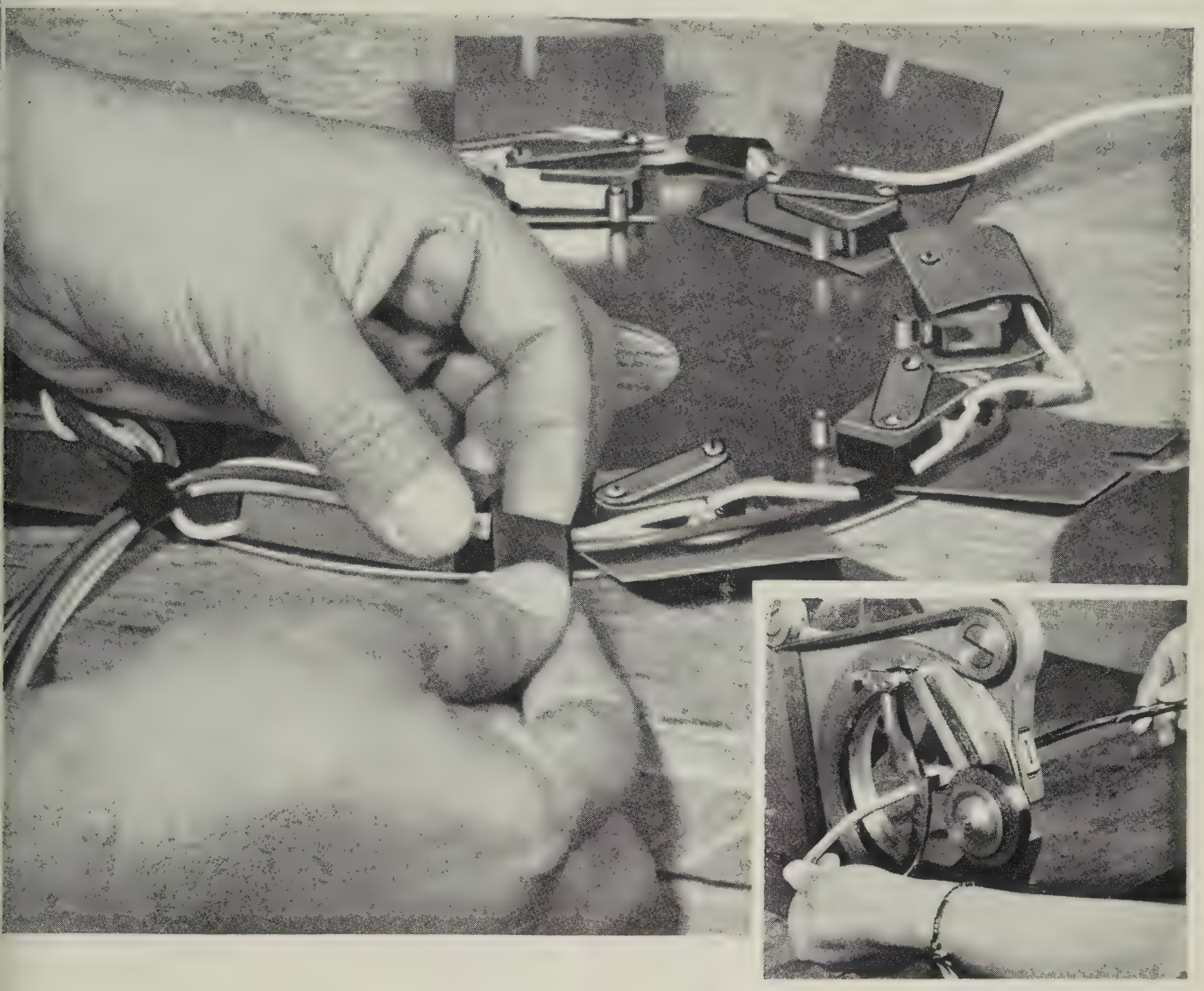
With the new system, the fiber glass reinforced polyester material is covered with a film of water to provide complete contact between detecting crystal and laminate. The inspector

moves the sensing head over the entire surface of the sheet. The presence of internal flaws is indicated by "blips" on the oscilloscope tube. If flaws are found, the material is rejected. The system replaces an ultrasonic procedure whereby the laminate was immersed in a tank of water, an awkward method which made accurate testing difficult.

Before the advent of ultrasonic testing, the only reliable inspection procedure was to saw a sheet into small sections and visually inspect the edges of each piece. Being a destructive test, this could be done only on a spot basis.

Encapsulated Neon Weatherproof Transformer

The first completely weatherproof luminous tube transformer—a hermetically encapsulated unit said to possess greater life expectancy than any neon transformer on the market—has been introduced by Jefferson Electric Co., Bellwood, Ill. The new product is claimed to be 25% lighter and 32% smaller than conventional models. Encapsulating material does not support combustion and its dielectric properties and resistance to arc tracking are reportedly superior to other approved materials now in use.



How Belvidere Manufacturing Co. Made an

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With J-M Dutch Brand Tape

J-M Dutch Brand Plastic Electrical Tape proved practical and inexpensive for Belvidere Manufacturing Co., of Belvidere, Illinois. High costs made necessary the need for replacement of "zip tubes" which enclosed twin cable harnesses in their Tint-A-Matic Paint Blender. Belvidere and J-M Dutch Brand engineers jointly solved the problem—and cut costs up to 80%—with automatically tape-wrapped harnesses.

Dutch Brand Plastic Electrical Tape may be the answer you seek, too. Providing efficient, low-cost insulation with 150% stretch and ability to conform readily to irregular surfaces, Dutch Brand Plastic Electrical Tape assures maximum versatility and performance.

Size and width varieties, too, permit top tape economy for each job—general usage, heavy duty protection and use with power-driven taping machines, or extra heavy duty where abrasion and wear are encountered.

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Pixilated Patents

By Mike Rivise

(Forty-third in a series of odd and interesting inventions in the electronics field from the files of the U. S. Patent Office.)

Clubs, lodges, secret societies, and other groups may find an electrical device patented by John Milton Seibert to be a great aid in charging new members with the seriousness of their initiation rites. An improved form of the old-fashioned "hot-foot" designed to keep new members hopping, it consisted of electrified rails and "walking electrodes" (shoes) to be worn by the initiate. The inventor described it as, "a simple and practical form of apparatus entirely harmless in its action and results, while at the same time producing an amusing and entertaining effect."

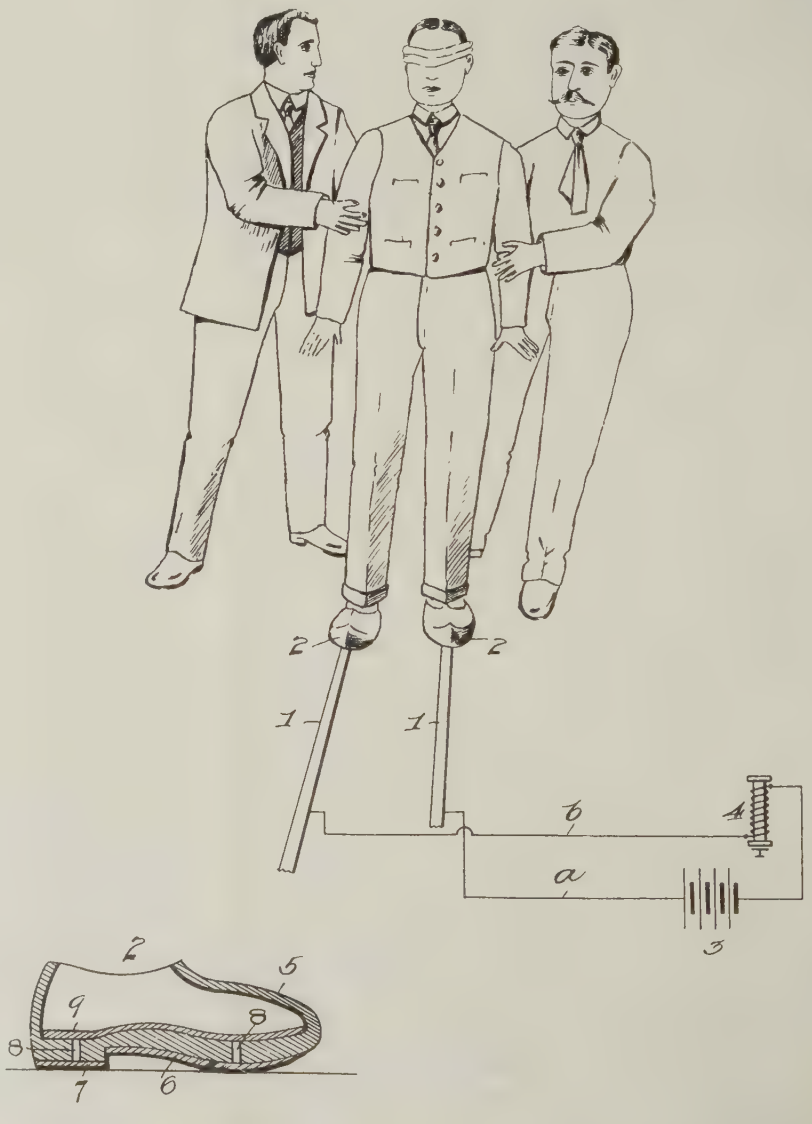
According to the description in patent No. 819,814 dated May 8, 1906, "the invention . . . consists of a pair of guiding-conductors 1 and a pair of walking electrodes 2. The latter are worn by the subject and (are) designed to be carried over and in contact with said conductors. The guiding-conductors are in the form of metallic rails or bands arranged in spaced parallel relation to constitute, in effect, a track and designed to be secured to the floor or other surface a suitable distance apart to permit the subject or candidate to easily walk upon the same. The said metallic rails or bands constituting the guiding-conductors are usually about an inch wide to form a substantial walking surface, and the same may be of any length desired, according to the extent of walk which may be planned for the subject or candidate.

"The guiding-conductors 1 are included in an electrical generator-circuit. This circuit essentially consists of the circuit-wires *a* and *b*, connected at one end, respectively, with the separate conductors and also suitably connected with the electrical generator or battery 3 and an electrical magnetic vibrator or induction-coil 4 to secure the necessary electrical action for shocking the subject when the electrical circuit is closed by the contact of both electrodes 2 with the said guiding-conductors.

"The walking electrodes 2 are preferably in the form of shoes or slippers, each consisting of the wooden body 5, provided on the exterior thereof with metallic sole and heel contact-plates 6 and 7, respectively. These sole and heel contact-plates each have a metallic pin or equivalent connection 8 with an inside foot electrode or plate 9, which is arranged within the shoe-body and is designed to form a contact member for the foot of the wearer."

Throughout the reading of this patent various doubts have come to mind regarding certain of the technical details. However, not wishing to seem impertinent and in view of the rather sketchy description of the apparatus, a charitable view has been adopted by this writer and these doubts will not be mentioned.

If, on the other hand, it is assumed that the equipment works as it should, it seems exceedingly unwise of Mr. Seibert to specify that the contacts should be made through wooden shoes. This, in the writer's opinion, unnecessarily provides the initiate with rather potent weapons. Smashed toes and barked shins could be among the more minor injuries suffered by the helpful guides who try to keep even a docile subject dancing on the rails.



is is a cutaway of an Epoxy encapsulated stator wound with Epoxy magnet wire. All-Epoxy—an ideal combination for severe applications.

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Epoxy can also be furnished in combination with Vitrotex (glass-served) for added thermal overload protection.

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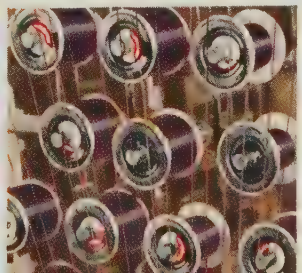

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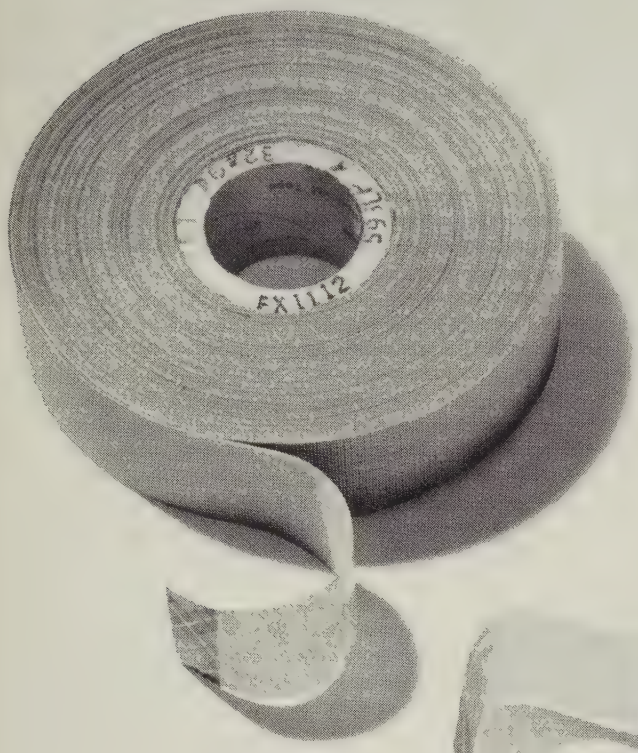

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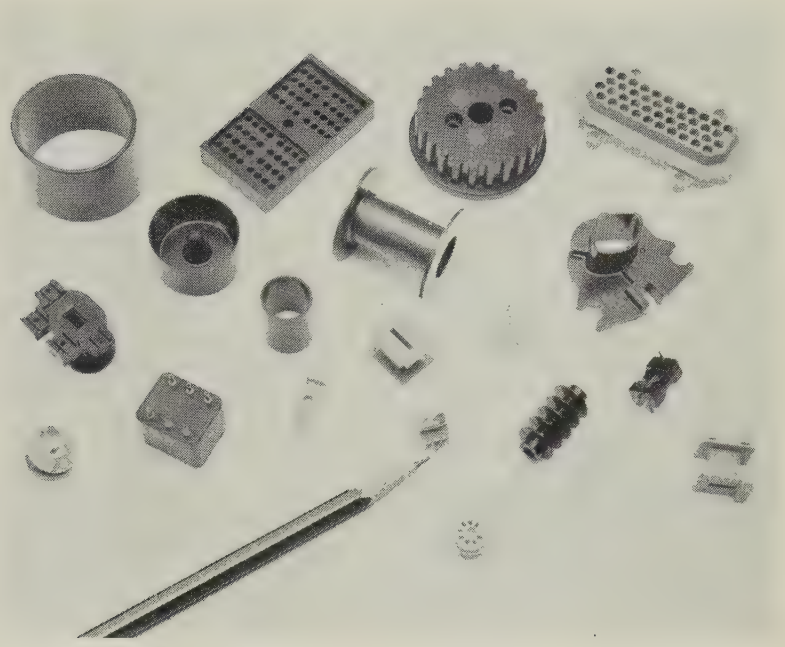

Photo courtesy Hysol Corp.

Methods and Equipment for Mixing, Metering, Dispensing, and Molding Epoxies

By John L. Hull, Hull-Standard Corp., Hatboro, Pa.

More and more individuals and companies need and want the outstanding electrical and mechanical results possible when epoxies are used. To get smaller electronic packages for communication equipment, computers, or missiles, we make smaller components. And because higher dielectric materials are required to insulate these components with minimum bulk, epoxies are a natural choice.

Epoxies also meet the environmental requirements of electronic components in rockets, walkie-talkies, aircraft controls, and even the telephone. They retain the necessary electrical and mechanical properties despite wide temperature variations, humidity extremes, and rough handling.

So the need for epoxies is obvious —but how do we work with this material?

To work with epoxies, we have to achieve the proper blend of resin and accelerator (or hardener or catalyst), and then place this catalyzed liquid resin in the appropriate shape—possibly around a component—and hold it there while the resin sets up or polymerizes into a solid.

Handling Problems

The liquid resin, especially the catalyzed resin, is sticky and hard to clean from surfaces where it is spilled. The catalyzed resin must be used promptly, since it is in the process of hardening or polymerizing. The proportions of resins and hardeners must be extremely accurate for any "control" in the gel time or curing time. Fillers—added to provide desired viscosity, thermal-conductivity, economy, dimensional stability, or strength properties — must be thoroughly dispersed, and kept dispersed until the resin is set. Discrete quantities of catalyzed resin must be metered fairly accurately, since we usually want to fill a mold or form, or surround a component, with *just* enough resin. And to achieve reliability of electrical characteristics, the entrapped air, moisture, or other volatiles must be removed, not only in the resin mix but also on components or molds. Heat must often be applied, during the pouring or flowing stages as well as during the cure, to insure certain desired properties.

Yes, the handling problems are many. But good progress is being made in handling epoxies. However, companies using epoxies must continue to demand better materials and better equipment. Equipment manufacturers must continually evaluate the needs of the industry and the available compounds, and must then develop new equipment that is prac-

tical, inexpensive, and simple to operate. And epoxy resin formulators must respond to user needs and equipment abilities with better resin combinations. Epoxy applications are rapidly growing, and this growth encourages better solutions to handling problems.

Four basic types of epoxy handling equipment will be discussed in this article—each type in actual successful use today, and each type having advantages as well as limitations when compared with another type.

Paper Cup and Popsicle Stick

Despite the humorous terminology, more epoxy material is probably dispensed in this way than in all other ways combined! The method consists of adding a measured quantity of liquid resin to a correct proportion of hardener in a disposable paper container, mixing it with a disposable stirrer, then pouring the mix into a mold where the catalyzed resin sets up in minutes or hours. Optional provisions include: 1) heating of the resin or of the resin mix to lower the viscosity for ease of pouring; 2) preheating of the form or component in the form for removal of some volatiles; 3) mechanical stirring to improve mixing and to save the strength of the operator; and, 4) oven heating of the poured mix for improvement of final characteristics.

Figure 1, continuous mixing and dispensing "Blendmaster" unit.

Advantages are obvious: low cost of equipment; simple operation; and practically any size component may be cast with this technique. Disadvantages are also obvious; possibly messy; only low production runs; much room for human error in mixing and pouring; and little control of variables of mixing, heating, and curing with resultant possible inconsistencies in end quality.

But the method works and the paper cup and popsicle stick system is used by most people when they start using epoxies. The epoxy resin manufacturers and the epoxy handling equipment manufacturers continue to be grateful for the economical beginnings that are possible.

Continuous Mixing And Dispensing Systems

Since epoxy resins must be mixed, it is easy to conceive of a storage tank of liquid resin and a storage tank of hardener, with lines from these two tanks joined to a common line leading to a faucet. When we want a shot of catalyzed resin, we just turn on the faucet and let the mix run out into the mold. In effect, this is what continuous mixing and dispensing systems do.

But it isn't quite that simple. In the first place, we have to proportion the catalyst or hardener to the resin rather accurately. So we need some sort of proportioning pumps or metering valves capable of handling the viscous liquids, possibly at temperatures as high as 200°F, and possibly with highly abrasive fillers in the resin. Such pumps and proportioning systems have been designed to work quite successfully.

But that is not all. We must thoroughly mix the resin and the hardener. Inadequate blending results in resin-rich areas in the final casting which require long cure times, and also causes catalyst-rich areas which cure too quickly with resultant poor quality, internal stresses, and probable rejects. So a mixing head must be incorporated to insure thorough dissemination of the hardener in the resin prior to dispensing.

When the resin and the hardener make first contact, the chemical reaction of polymerization begins. It is important that the desired proportions be constantly maintained—and that the mixed resin be dispensed *promptly*. If a mix is allowed to remain too long in the dispensing apparatus, it may set up, causing a difficult cleaning problem. Mixing heads generally incorporate solvent cleaning arrangements, or are designed for rapid disassembly for cleaning, or both. Remember, too, that a mixing head, in dispensing a succession of metered charges, must not have stagnant pockets of mixed resin—such pockets or films of catalyzed resin will eventually gum up the mixing head, and may adversely affect the mix being delivered to the mold.

Several equipment manufacturers offer continuous mixing and dispensing equipment. Such units are in production lines where hundreds or thousands of components must be produced daily—from large transformers or motor windings down to small semiconductors.

Some additional handling equipment often used in conjunction with continuous mixing and dispensing systems would include curing ovens (as the next step in the production process) and preheating ovens (often used for drying and heating forms or components prior to the casting operation).

A simple continuous mixing and dispensing "Blendmaster" unit is shown in figure 1. Storage tanks for resin, hardener, and solvent are visible at the top. The mixing and dispensing head is located in the center. Controls for proportioning the resin and hardener, for dispensing the varied quantities, and for effecting a solvent flush, are located on the panel in front of the operator. In use, when an operator holds a form or mold under the nozzle and actuates the dispensing valve control, catalyzed resin flows out of the head. In this unit, resin and hardener are brought together only when the dispensing valve is opened. An agitator mixes the two by mechanical shearing action and dispenses the mix immediately.

The catalyzed resin contacts only stainless steel and "Teflon" surfaces in the unit. Cleaning can be accomplished readily by a solvent flush without disassembly. The head is disassembled by removing a knurled nut from the nozzle and loosening a Jacobs chuck connecting the agitator to the motor shaft.

There are a number of other units commercially available for mixing and dispensing epoxies. They differ in the method of proportioning or in mixing, and in a number of other details. Storage tanks and size of the mixing head can be selected for the production requirements of the user. Most of these continuous dispensing units are available with accessory equipment for degassing the resin prior to casting in order to eliminate absorbed air. Some of these units have facilities for casting into a vacuum to avoid entrapped air in the mold or in any component to be encapsulated. Some units have pressure stalling features to pressurize the delivered resin, driving it into fine nooks and crannies of the mold or encapsulated component. Apparatus for controlled heating of the storage tanks is frequently required to lower the resin viscosity. Provision is generally made in these units for fillers to be added to the resin storage tank, and simple agitators can be provided to prevent the filler from settling out.

The advantages of such dispensing equipment include high production rates and minimum handling problems. Dispensing rates of up to several pounds of catalyzed resin per minute enable even the largest requirement to be met. The disadvantages frequently cited by users of such equipment include difficulties of assuring accurate proportioning, especially with small "shots;" elimination of "drool;" maintenance of pumps and check valves in those units having such components, particularly when abrasive fillers are used; and cleaning of the system. Additionally, fairly high quantities of molds may be needed to hold the dispensed resin until after cure, and cleaning of such molds may prove a costly chore.

Equipment manufacturers have constantly improved the continuous mixing and dispensing systems, and such units will probably continue as a vital tool for relatively high production of epoxy encapsulated components.

Batch Vacuum Potting Equipment

As many realize, epoxy resins have an affinity for air. Such air can be absorbed into the resin with no apparent loss of electrical or mechanical properties. But there is a limit to the amount of air that can be absorbed or dissolved in a given quantity of resin, and when that limit is exceeded, air bubbles or voids appear. Less air can be absorbed in warm resin than in cold resin. As a result, in resins relatively saturated with air, the normal heating from the exothermic reaction may release air bubbles.

Certain high quality epoxy castings must be void-free. In such cases, the quantity requirements are usually low, and the cost is generally secondary to reliability.

To meet such requirements, vacuum potting is desirable. A high degree of vacuum degassing can be achieved with continuous dispensing units and a high degree of vacuum drying and evacuating of molds and parts to be encapsulated can be achieved with continuous vacuum casting equipment, but highest quality is presently achieved with batch vacuum potting.

Figure 2 shows a vacuum potter for high quality casting. Actually, it represents a glorified paper cup and popsicle stick system, but uses vacuum to degas the resin and to thoroughly dry and evacuate the forms of components to be encapsulated. The actual casting is under vacuum.

In figure 2, the upper chamber holds a disposable container filled with the resin to be degassed. After the container has been placed in the top chamber, heat and vacuum are applied for a period of up to 15 or 20 minutes or long enough to degas the resin thoroughly. An operator observes the bubbling of degassing through a sight glass in the top and can carefully regulate the vacuum to minimize foaming or splashing. A mixer may be provided to stir a filler during the degassing process. The

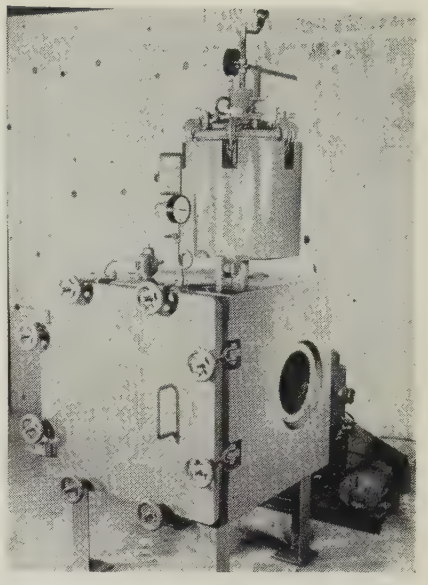

Figure 2, vacuum potter for high quality casting.

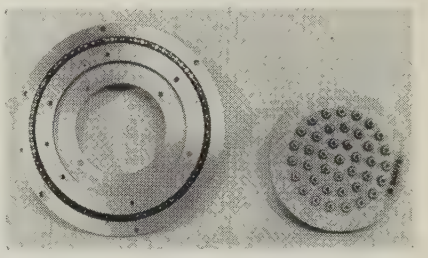

Figure 3, two unusual castings requiring void-free insulation between terminals of the header at the left and on the commutator ring at the right.

hardener can be in the original mix or can be added through a vacuum lock after degassing.

Molds or components are placed in the lower casting chamber on small turntables. The chamber door is shut and heat and vacuum are applied to remove all volatiles from the components or molds before casting. This vacuum drying cycle may take up to half an hour or longer, depending on the components and the amount of moisture to be removed. When the degassing and drying cycles are finished, the operator punctures the bottom of the disposable container in the degassing chamber, allowing the resin to flow by gravity into the disposable director funnel. He then observes the stream through the sight glass of the casting chamber, and rotates the turntable with hand controls so that each mold is brought under the stream for filling. After

casting, the vacuum is gently broken. The next step is usually oven curing.

While this batch technique does not offer especially high production, since cycles often require from one half hour to one hour, the extremely high quality casting obtained has justified its use in dozens of applications. When encapsulating windings, a high degree of impregnation can be achieved if the resin viscosity is kept reasonably low.

Cleaning of the unit is simple since the disposable containers are thrown away and the resin touches no pipes or valves. Only the mixing blades need be cleaned, and spillage must be wiped from the turntables. If the process is interrupted during casting, the resin container is plugged, and although the catalyzed resin is wasted, it does not clog up the equipment.

Figure 3 shows two unusual castings requiring void-free insulation between terminals of the header at the left and on the commutator ring at the right. These components measure about four or five inches in diameter. A more typical collection of components frequently encapsulated with this type of equipment is shown in figure 4. Various transformers and coils which must be produced to especially close specifications for heat loss and dielectric and other factors can be readily produced on vacuum potting equipment.

Transfer Molding Equipment

The epoxy handling systems described previously have all dealt with liquid resins and catalysts. And while they do a good job for many applications, they have their disadvantages. The liquid resin presents a clean-up problem. Cast components generally require curing in ovens for several hours. If reusable molds are used, the molds are "tied up" in the process, and mold cleaning requires some time and effort. Additionally, there are variables in proportioning, mixing, and metering which can affect product quality. And because the liquid resin processes take considerable time, they often present barriers to truly high production rates of tens of thousands of components per day.

Accordingly, some epoxy resin formulators have developed dry epoxy molding compounds which lend themselves to handling in conventional compression and transfer molding presses used for thermosetting compounds. Figure 5 shows some of these compounds in their granular state. Epoxy compounds reinforced with glass, "Dacron," and asbestos fibers are also possible.

The dry epoxy molding compounds are ready for use with no further blending or mixing required. In a molding press they are subjected to heat (from 250°F to 325°F depending on the application) and to pressure (from 100 psi to 8000 psi depending on the compound used and conditions). Under heat and pressure, the epoxy molding compound becomes liquid and flows into mold cavities and around parts to be encapsulated. Under prolonged heat and pressure, the material cures or sets up in periods as short as 40 seconds or as long as many minutes, depending on the parts being molded. The press then opens the mold, parts are ejected, and the press is ready for the next shot. Usually, no post curing of the parts is required.

We therefore have a very quick process—no prolonged cures in ovens, no complex mixing equipment, and no quantity of molds tied up for hours. We do not have vacuum degassing nor do we achieve much impregnation, but the molding process, using multi-cavity molds in modern transfer and compression presses, is

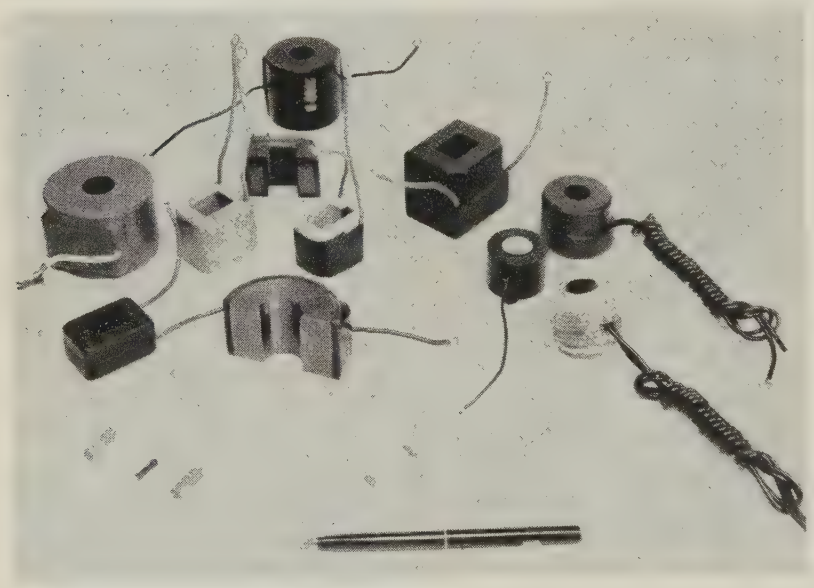

Figure 4, typical collection of components frequently encapsulated with vacuum potting equipment.

Figure 5, dry epoxy molding compounds in their granular state.

now meeting the needs of component manufacturers who must produce high quantities day after day.

Some parts lend themselves to compression molding. This process uses a heated mold with upper and lower halves molded to upper and lower platens in a press as shown in figure 6. A metered amount of the dry epoxy compound is placed in the mold cavities and the press is closed. As the top half of the die or force enters the lower half of the die or cavity, and as greater pressure is applied, the dry epoxy molding compound becomes liquid and then solid.

Where complex shapes are required and where encapsulation of delicate components is called for, transfer molding is used. In this process, the components to be encapsulated are placed in the cavities, suitably positioned and supported. The heated mold is then closed. A metered charge of dry epoxy compound is placed in the mold "pot," and a transfer plunger is actuated which drives down into the pot, forcing the dry compound to become liquified material and causing it to flow through runners and gates into the closed cavities —much like die casting. After a cure time under heat and pressure, the press opens, parts are ejected, and we are ready for the next shot.

The console type press shown in figure 6 has been specifically designed for epoxy molding and encapsulating. It is a self-contained, hydraulically actuated, straight ram press with semi-automatic controls for both compression and transfer molding. Rated at 25 tons clamping pressure and 7 tons transfer pressure, the press has a die space of 18″ x 18″ to provide for the maximum number of components at the lower pressures called for with epoxy compounds.

Inasmuch as the transfer molding technique of handling epoxies may be new to some readers, let's look at a few illustrations.

Figure 7 shows several typical components which are now being encapsulated in large quantities by the transfer molding technique. Items shown include metallized resistors, deposited carbon resistors, thermistors, diodes, chokes, and a variety

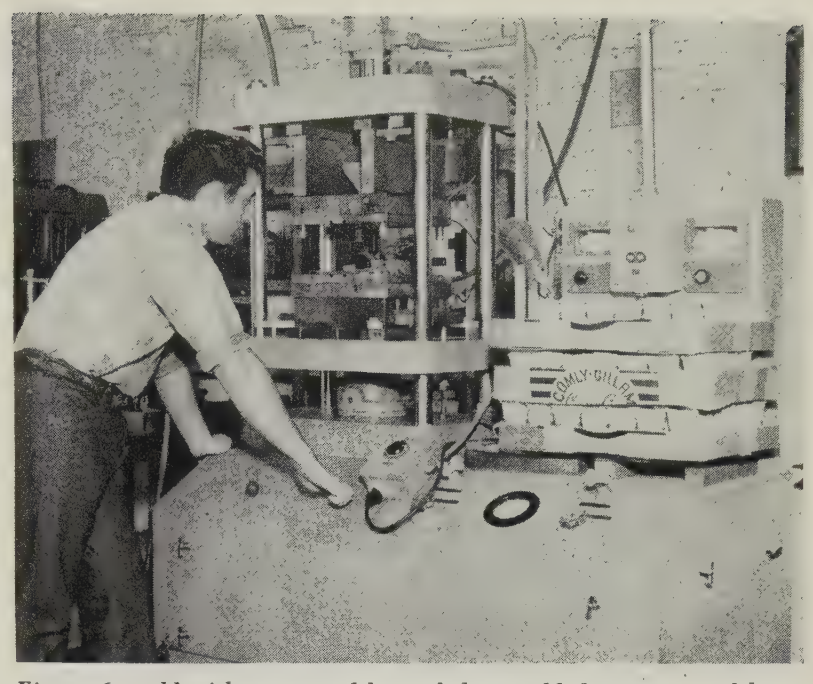

Figure 6, mold with upper and lower halves molded to upper and lower platens in a press.

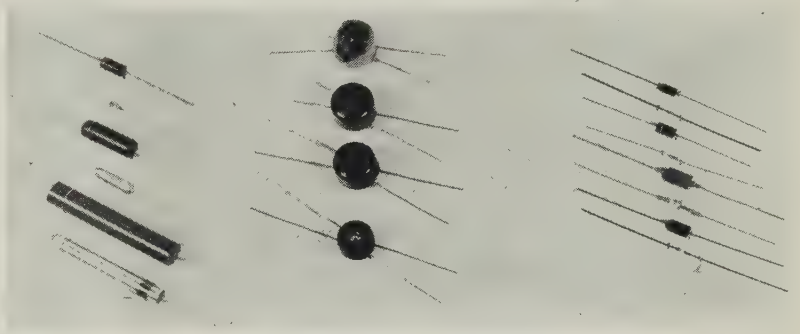

Figure 7, typical components encapsulated in large quantities by the transfer molding technique.

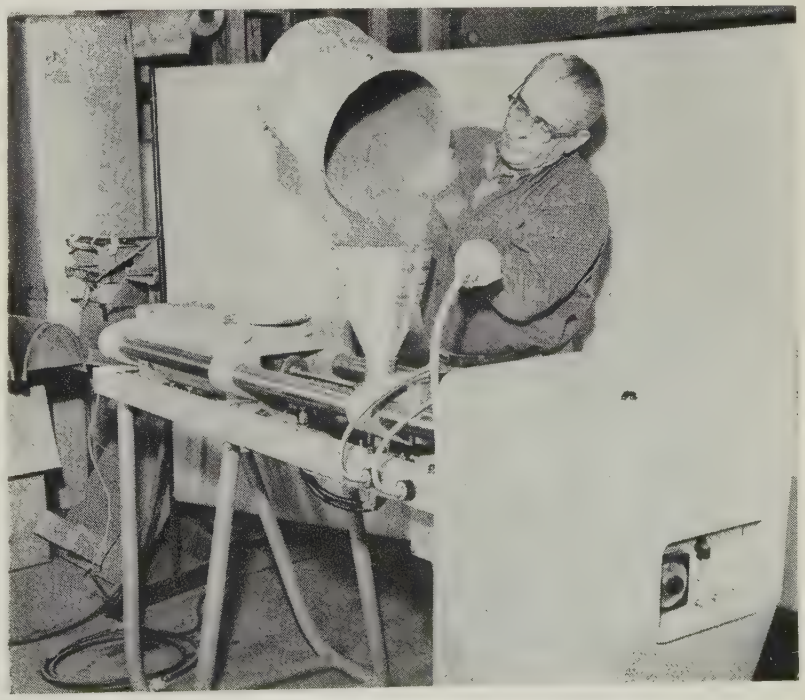

Figure 8, small air-actuated transfer molding press.

of other windings. Other components which are being processed by this technique include motor stators, small transformers, coils of various sizes, slip rings, brush assemblies, etc.

Much experimental encapsulation and some production encapsulation has been done in a small air-actuated transfer molding press shown in figure 8. It handles unheated granular material and meters and feeds it automatically. Because of its small size and low mold cost, it has proven an inexpensive development unit. Figure 9, for example, shows a single cavity experimental mold for this press designed for encapsulating a small, delicate semiconductor. Insulation, mechanical protection, and moisture sealing were requirements of this application. The runner, gate, and cavity are visible, as well as some of the parts, both before and after encapsulation. Despite the fragility of the part, the technique has proven highly successful and is in current use. Similar single cavity molds have been used by many manufacturers in evaluating the technique for their particular products and production requirements.

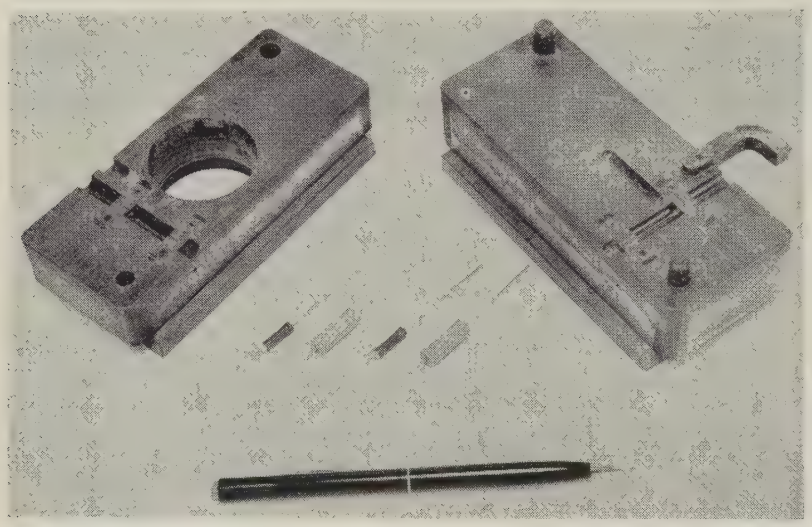

Figure 9, single cavity experimental mold designed for encapsulating a small, delicate semiconductor.

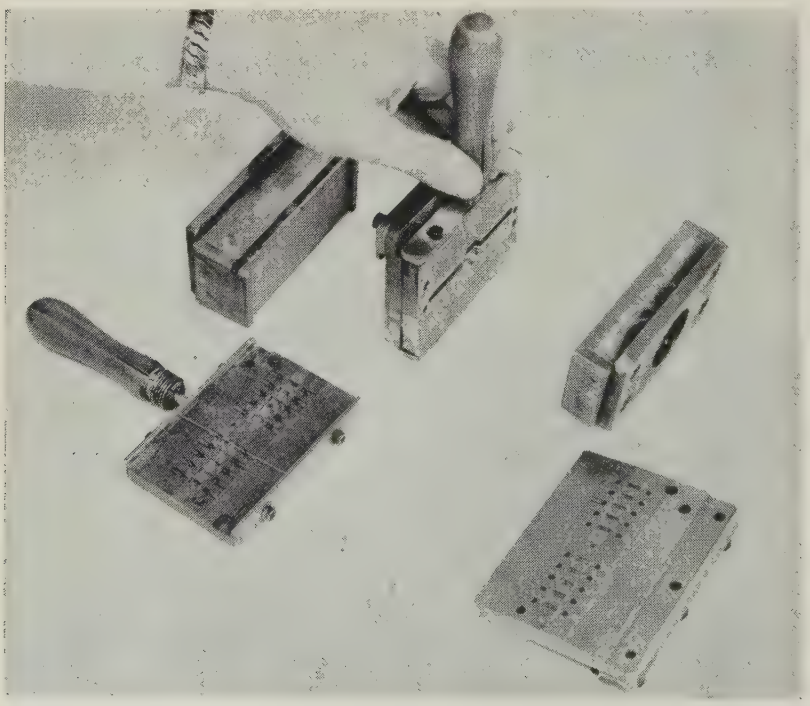

Figure 10, typical production mold for use in the small horizontal transfer press.

Figure 10 shows a typical production mold for use in the small horizontal transfer press. In this eight-cavity mold, parts are loaded by an operator and the mold is then closed and placed between the press platens where it is suitably supported. The operator actuates a cycle switch causing the press to close and feed a metered charge of material down the transfer tube to the mold. While the one mold is undergoing cure, the second mold is being cleared of molded parts and prepared with new inserts for the next run. From 2000 to 3000 encapsulated components can be produced per eight-hour shift by this technique using one operator, one small press, and two molds. Using larger presses, with several dozen cavities per mold, production rates as high as 6000 to 10,000 parts per eight-hour shift can readily be achieved.

Advantages of the molding process for epoxy handling are the speed with which the process is completed, the ease with which the resins are handled, and the minimum amount of clean-up. Molded parts, furthermore, offer a surface finish and overall appearance far superior to the appearance of most cast components. And high production rates possible with large presses and multi-cavity molds lead to real economies in manufacturing. Disadvantages of this technique lie in the cost of equipment—a press may run from $5,000 to $30,000, depending on size and type, and a mold may cost from $1,000 to $10,000. The system should not be considered unless high quantity production is required.

Summary

From the preceding remarks and illustrations, it can be seen that several types of proven equipment exist for handling of epoxy resins on a commercial production scale. None of the systems is perfect, but you will find the equipment manufacturers eager to improve equipment each year to meet the needs and the findings of the industry.

GOOD CURRENT THINKING: PLYMOUTH CABLE TAPES

Thinking about current, since the turn of the century, has always included serious consideration of Plymouth cable and harness tapes. Plymouth Rubber special purpose and standard tapes have always been famous for reliability in the best current channels.

Plymouth tapes, made to specifications for the cable industry, adhere to the most exacting standards and are fabricated under the strictest quality control. Some typical examples are: GRS, butyl, neoprene, PVC, polyethylene, coated mylar, coated paper and laminated. Plymouth specializes in printed tapes, and adhesive and non-adhesive vinyl harness tapes in many colors.

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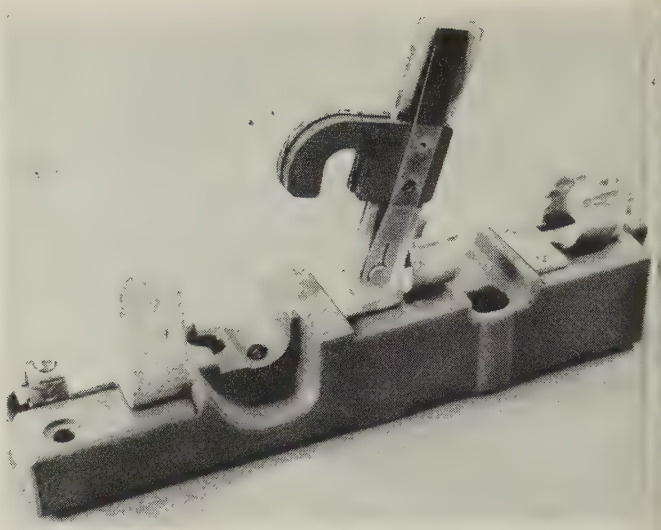

Figure 1, movable contact blade assembly with fibre insulating hooks.

Fibre Insulation for Switches

When a switch won't close because the fibre insulation absorbs moisture too readily and prevents engagement of knife blade and contact, the temptation is to solve the difficulty by over-specification and let the cost zoom where it may.

Just such a problem arose in the heavy duty industrial safety switches manufactured by Federal Pacific Electric Co., Newark, N.J. In these switches, which employ unit pole construction, each contact is placed between a pair of fibre yoke hooks. These hooks engage an insulated steel operating bar and must withstand the shock of the quick-make and quick-break action when this bar drives the contacts home and when the bar pulls the contacts out at high disconnecting speed.

In outdoor installations, or where switches are mounted in high humidity locations indoors, a conventional fibre yoke might swell, thus interfering with the operating action of the switch.

In their search for an insulation material to meet the application conditions, Federal Pacific engineers checked and tested a relatively new type of fibre insulating material, a combination of cellulose fibers and phenolic resin, formulated for parts that must retain electrical properties under conditions of high humidity. It is one of a series of structural and electrical sheet fibre materials, produced by the beater addition method, and is designated Duroid 800 (Rogers Corp., Rogers, Conn.). Characteristics claimed for these products are homogeneity (the result of thorough blending of fiber and resin during the beater addition process), high mechanical strength, rigidity, and

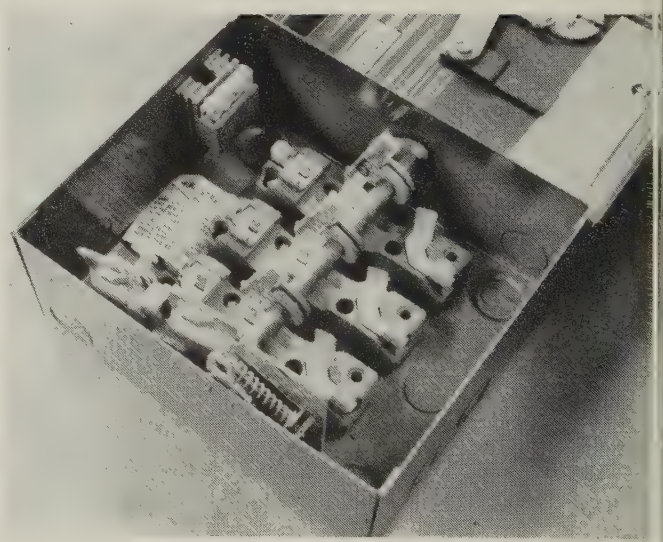

Figure 2, completed switch assembly with fibre yoke hooks gripping operating bar.

firmness.

Specification of the material for Federal Pacific distribution apparatus was its first use in such an application. A key feature of the material is its low (for a fibre product) water absorption rate of 20% after 24 hours immersion as compared to a rate of 55-66% for the standard type fibre material.

Recognized by Underwriters' Laboratories as suitable for the sole support of current carrying parts, the material

is mechanically stronger when wet than dry, having a wet bursting strength of over 100%. Electrical properties are: dielectric strength of 500 vpm bone dry and 300 vpm at 7% moisture content, and arc resistance of 75-100 seconds.

Federal Pacific engineers also found applications for two other materials in the Duroid series. Duroid 225, the most formable of the electrical grades in this class of materials, is used in Federal Pacific's QMQB fusible switch line because of its ability to be creased sharply without cracking. It is also employed as a bushing to prevent feed-in wires from coming in contact with sharp metal.

The third material, Duroid 700, which retains its dielectric strength to a large extent under exposure to higher humidities, serves as sheet insulation between the hot parts and the steel enclosures in the Stab-lok line of circuit breaker load centers. It is recognized by Underwriters' Laboratories for use as a mechanical and electrical barrier at temperatures up to 90°C.

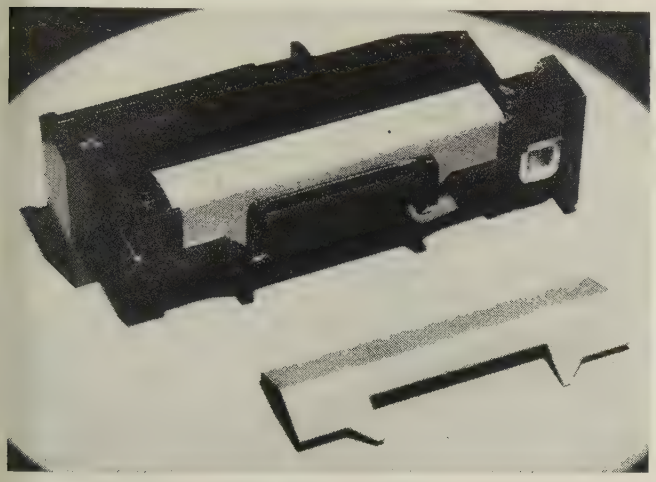

Figure 3, material for this insulated assembly for Federal Pacific's new QMQB fusible switch was selected primarily because it can be creased without cracking.

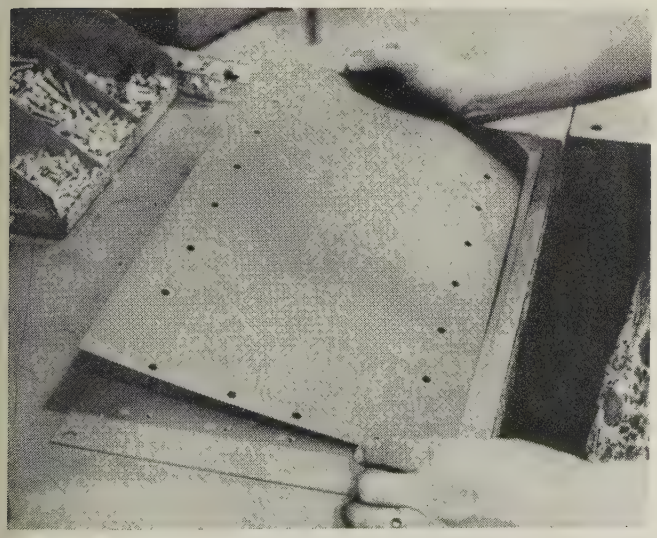

Figure 4, blanket of insulation material is assembled to base of Stab-lok circuit breaker panel housing at one of Federal Pacific's Newark, N.J., plants.


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Plans Finalized for December Insulation Application Conference in Chicago

Numerous committee meetings and reports indicate that all work is well underway on final plans and arrangements for the Third National Conference on the Application of Electrical Insulation, to be held December 5-8, 1960, at the Conrad Hilton Hotel, Chicago. Co-sponsored by the American Institute of Electrical Engineers and the National Electrical Manufacturers Association, the conference is under the general chairmanship of William Hoffer, Johns-Manville Corp.

Last year's conference attracted an attendance of more than 1,700—this figure is expected to soar to at least 2,500 for the 1960 meeting because of the Chicago location, ever-growing interest in the insulation field, and increased need for such a conference. Everyone who attends the Chicago meeting will be offered a complete "package" of outstanding technical papers, exhibits, a banquet featuring men of national importance and prominence, and the opportunity of exchanging information on a "person-to-person" basis.

Technical Program

Technical sessions will be held morning and afternoon Dec. 5 and 7, and morning only Dec. 6, under the direction of program chairman Thomas Hart, Silicones Div., Union Carbide Corp., and divisional program chairmen E. O. Hausmann, R. W. Jorgensen, and J. S. Hurley. It is expected that four sessions each will be held Dec. 5 and 7 in the areas of distribution and control apparatus, electronics and communications, and rotating machinery. On the morning of Dec. 6 (and perhaps on other days) it is tentatively planned to hold sessions on testing and evaluation, "what makes insulation tick?", and "a fresh, practical look at insulation materials and applications." The latter session, to be directed by *Insulation* contributing editor Graham Lee Moses of Westinghouse Electric Corp., will feature authoritative, down-to-earth discussions of insulation materials and purposes, and insulation applications and requirements in electronics, transformers, and rotating equipment. This session will be of interest to men who might not have a highly technical understanding of insulation—purchasing agents, marketing men, students, and engineers who lack a broad, penetrating insulation education or background.

Each of the technical sessions will be aligned with a central session theme. And for each session there will be a director who will be the session leader as well as a session manager who will make sure all arrangements work smoothly.

Marketing Program

In addition to the technical program, developed around a format which has the insulation material user in mind, there will also be a marketing program designed primarily for the men concerned with insulation sales and merchandising. This meeting will be held the morning of Dec. 8 under the chairmanship of E. J. Phelan, Prehler Electrical Insulation Co., with the assistance of Thomas Keegan and Robert McKeown.

At the session, A. L. Baldock, General Electric Co., will speak on "How to Introduce a New Product"; Charles P. Mills, Minnesota Mining and Manufacturing Co., "How to Make an Insulation Market Research Analysis"; and Thomas Keegan, Federal Insulation Co., "How the Customer Should Treat the Salesman." A skit is also planned on "How Not to Sell Insulation"—thespians will be Robert E. Joseph, Allis-Chalmers Manufacturing Co.; William Carlstrom, Insulation Manufacturers Corp.; and W. R. Swenson, Minnesota Mining and Manufacturing Co. William Gove, nationally known speaker, will be the featured speaker at the marketing luncheon.

Thursday afternoon and evening, Dec. 8, are being reserved for sales meetings which insulation manufacturers and distributors might wish to hold. Such sales meetings will not be held at any other time during the conference in order to avoid interference with other program events and sessions.

Commercial Exhibits

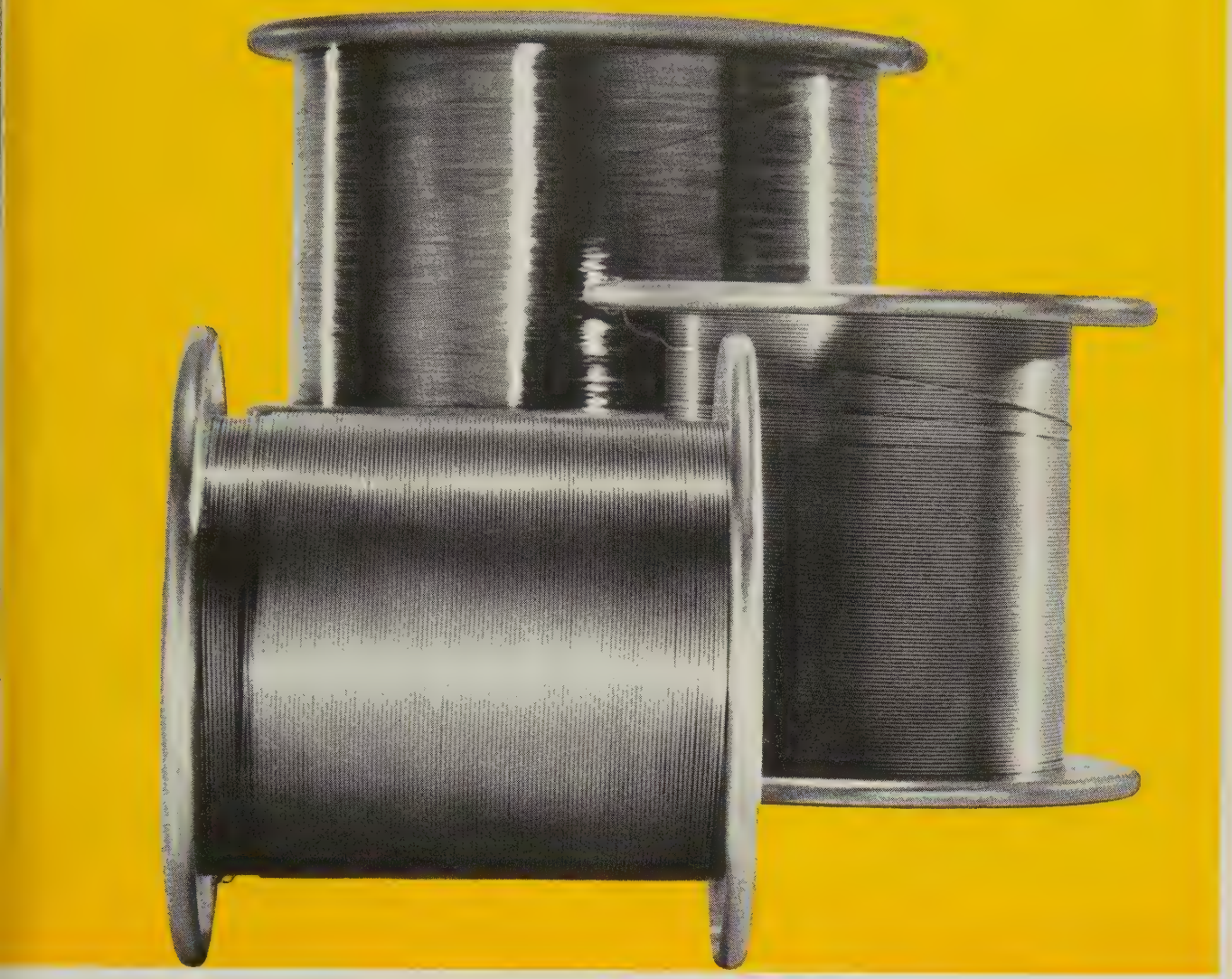
Exhibit chairman Arnold Bohn, Dow Corning Corp., and the assistant chairman, W. F. Michener, L. Frank Markel & Sons, report that exhibit spaces are being sold at a fast pace to manufacturers and distributors of electrical insulation materials, wire, cable, test instruments, and processing equipment. Because only 135 exhibit booths are available, they are expected to be sold out promptly. Prices vary from $325 to $425. Exhibit hours will be from noon to 9:00 p.m., Dec. 5, and from noon to 6:00 p.m., Dec. 6 and 7.

Banquet and Golden Omega Award

Another outstanding, industry-wide banquet will be held at this year's conference. Scheduled for the evening of Dec. 6 in the Grand Ballroom of the Conrad Hilton, it will surpass last year's successful banquet which was attended by about 1200 people. Toastmaster will be C. B. Burnett, president, Johns-Manville Corp. One of the country's leading industrialists will probably be the featured speaker. The banquet will also be the scene for the presentation of the Golden Omega award to some man responsible for significant technological achievements. Last year's Golden Omega award went to Vice Admiral Hyman Rickover, USN. W. F. Hugger, Sun Chemical Corp., is in charge of the banquet. He is assisted by H. H. Chapman, Jr., Owens-Corning Fiberglas Corp., and John E. Byrne, J. J. Glenn and Co. Banquet tickets will again be priced at $15 each. Individual tickets or complete tables of 10 tickets may now be ordered by send-

(*Continued on page* 32)

SYLVANIA MAKES ALL THREE — ALLOY, CLAD AND PLATED WIRE



How to speed up design of new products

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With design time for high-temperature equipment so much at a premium, it pays *not* to get bogged down by noncreative engineering details. Case in point: selecting wire to meet specific conductivity needs in corrosive or oxidizing atmospheres.

You can save valuable time by calling on Sylvania for a wire recommendation. You see, Sylvania knows wire—knows the particular advantages of each kind. And of all major manufacturers, only Sylvania makes all three types of bare wire—alloy, clad and plated. Available in a complete range of sizes—.002 to .250, retains optimum characteristics at temperatures up to 1600° F.

Result? Your Sylvania wire recommendation is unbiased. It's based on *your* design's needs and is not restricted by a limited line. You can get full details for future use — or timesaving help on your present project —by writing Sylvania Electric Products Inc., Parts Division, Warren, Pennsylvania.

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ing payment to J. E. Byrne, J. J. Glenn and Co., 605 W. Washington Blvd., Chicago 6, Ill. (make checks payable to C. O. Newlin, NCAEI Treasurer) —best locations will be assigned on a first come, first served basis.

Local Arrangements, Tours, and Registration

The local arrangements committee will be responsible for all coordination and details which must be handled locally including hotel arrangements, registration, ticket sales, tours, etc. A. S. Gray, Insulation Manufacturers Corp., is chairman. Other committee members are J. H. Martin, L. R. Samelson, C. O. Newlin, E. J. Phelan, T. C. Keegan, A. J. Wiltger, G. F. Fratto, J. E. Byrne, R. R. Hanna, R. G. Tiffany, J. P. Haughney, J. C. Richardson, J. A. Bente, M. W. Snover, and D. W. Stewart.

Hotel reservations should be made by writing directly to the Reservations Manager, Conrad Hilton Hotel, Michigan Ave. and Balbo Dr., Chicago. Full registration fee is $15 which permits attendance at all technical sessions. Advance registrations with payment should be sent to A. J. Wiltger, Union Carbide Corp., Silicones Div., 230 N. Michigan Ave., Chicago 1, Ill. —checks should be made payable to C. O. Newlin, NCAEI Treasurer.

Plant tours for the afternoons of Dec. 5, 6, and 7 are being arranged for all those interested by R. R. Hanna, Owens-Corning Fiberglas Corp.

Other Conference News

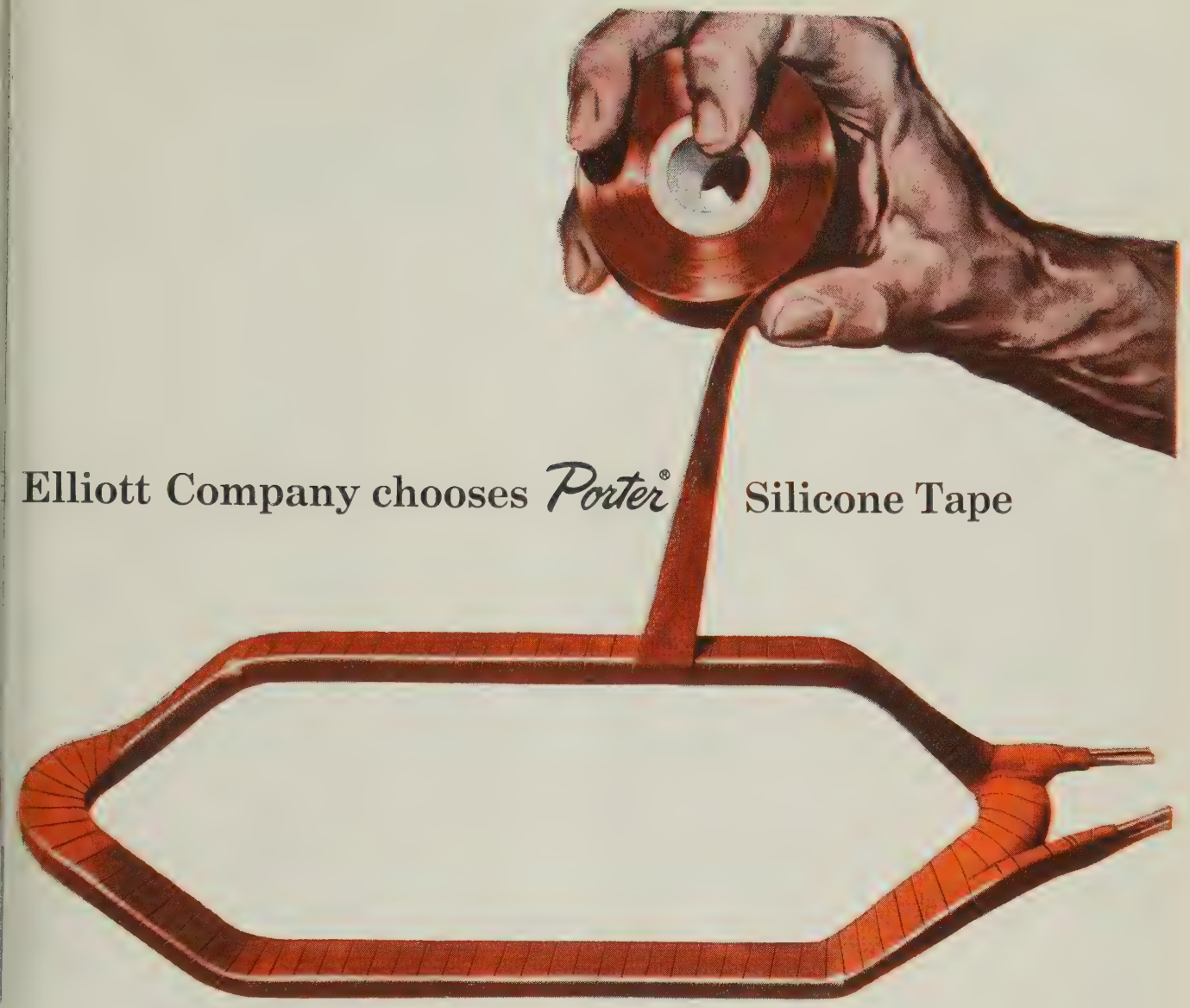
Applications for membership on the general conference committee are still being welcomed from all those interested in the insulation field—only one voting membership per company or division is permitted. Such applications should be sent to W. G. Hoffer. General Conference Chairman, Johns-Manville Sales Corp., 22 E. 40th St., New York 16, N.Y., or to Fred Huber, Jr., National Electrical Manufacturers Assn., 155 E. 44th St., New York 17, N.Y.

The next meeting of the conference executive committee is slated for July 14-15 while the next meetings of the general conference committee are scheduled for Sept. 13 and Nov. 1, the latter date to be the annual meeting.

It has been recommended that the fourth annual conference be held the week of Feb. 18, 1962, at the Shoreham Hotel in Washington, D.C., and that annual meetings starting in 1963 be held in September or October each year in other major cities.

Gage Measures Coatings Inside Small Tubes

Accurate measurement of coating thickness inside small-diameter tubes is now possible by means of two miniaturized gages designed by the National Bureau of Standards for the Army. These gages make use of the reflected field from eddy currents induced in the specimen. They reportedly are capable of measuring internal coatings in 0.30-inch and 0.50-inch tubing having lengths of several feet wtih a resolution of less than 0.1 inch. The measurements are non-destructive and are localized to a small area.



Elliott Company chooses *Porter*® Silicone Tape

for mechanical stability and extended motor life!

After extensive research into new materials and methods, Elliott Company, a division of Carrier Corporation, has developed the first really mechanically-adequate silicone insulation system—with "Porter" Silicone Tape. Vulcanized into a void-free homogeneous structure, "Porter" Silicone Tape provides outstanding mechanical and sealing properties for applications requiring class H insulation. In addition to flexibility and moisture protection, the Elliott "Fabri-Lastic" system provides durability and toughness as well as excellent thermal stability at high temperatures.

Thermoid Division offers the widest range of silicone tapes on the market today. And continuous research and development is being conducted to make available silicone elastomer materials with characteristics to meet customers' constantly changing needs. Thermoid Division engineers are available to work with you, as they worked with the Elliott Company, to develop the right combination of silicone elastomer and compatible materials for your requirements.

For fresh stocks of "Porter" Silicone Tape or information on special design characteristics, write *Thermoid Division, H. K. Porter Company, Inc., 200 Whitehead Road, Trenton 6, N.J.*

Ask for this free brochure with actual tape samples.

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Insulation Tests

Thermal Shock Resistance of Embedding Compounds

These articles by H. K. Graves, Supervisor, Electrical Insulation Section, Materials Laboratory, New York Naval Shipyard, are designed to explain the purpose, reasons, operation, meaning, and interpretation of results, etc., behind various tests for electrical insulation. Mr. Graves is also immediate past-chairman of Committee D-9 on Electrical Insulation Materials of the American Society for Testing Materials.

Since the early days of the use of embedding compounds when they were used mainly to protect components, resistance to thermal shock has been a major problem. Fillers added to the compound generally will increase shock resistance. In more recent years, the epoxies, although generally good in shock resistance, have been improved even more by compounding to make them less rigid. Compounds are poor in shock resistance for several reasons including rigidity, high shrinkage during cure, and structural weakness (they break apart when they shrink around an object as they are cooled by ambient conditions).

A considerable amount of work has been done on this characteristic but results are still largely qualitative although many attempts have been made to provide a quantitative method. Various sized pins have been embedded, spaces between pins have been graduated, distances from embedded objects to casting surface have been varied, and different embedded shapes have been evaluated—all with only limited success.

All available methods were studied by the ASTM embedding compound group and the method finally adopted was from a military specification (MIL-I-16923C). This method employs simple steel hex bar which can be obtained as bar stock and sawed into short lengths. Originally, a mold of glass tubing was used to make the casting around the bar and this was broken away after the specimen was cured. However, the glass tubing was not uniform in size and presented sealing problems at the base. Consequently, reusable molds of aluminum or brass were substituted. The method is mainly a go no-go method except that the upper temperature can be varied and the materials can be graded to some degree. The method is now included as a part of ASTM designation D1674-59T, "Testing Polymerizable Embedding Compounds Used for Electrical Insulation."

The method defines thermal shock resistance of an embedding compound as the ability of four out of five specimens, each containing a hexagonal bar, to withstand 10 thermal cycles without fracture.

It is clearly stated that the method is useful for screening but cannot represent all conditions of service. These, of course, will vary all the way from very severe conditions such as large irregular shaped components involving abrupt changes in compound geometry—to small spaced embedments which will cause very little stress or applications where temperature changes will be slow or almost non-existent. The method points out that embedments may be subjected to variations in temperature because of embedded heat sources and wide temperature variations in service as perhaps in aircraft applications. Mention is made of the effect on thermal shock resistance of the resin-filler-curing agent combinations used, and the curing conditions employed.

The apparatus requires a forced draft oven capable of maintaining the required temperature in accordance with grade A units of the "Specification for Enclosures and Servicing Units for Tests Above and Below Room Temperature" (ASTM Designation: D1197). This oven must be provided with a small opening so that specimens can be inserted without opening the door to minimize any drop in oven temperature. The specimens must be supported by the pin extending from the compound (figure 1). A simple rack of low thermal capacity is normally used to hold all five specimens. Specimens should be spaced so that air and liquid can circulate freely between them and so that they are quickly visible for examination between cycles.

Alcohol has been quite generally used for a low temperature medium

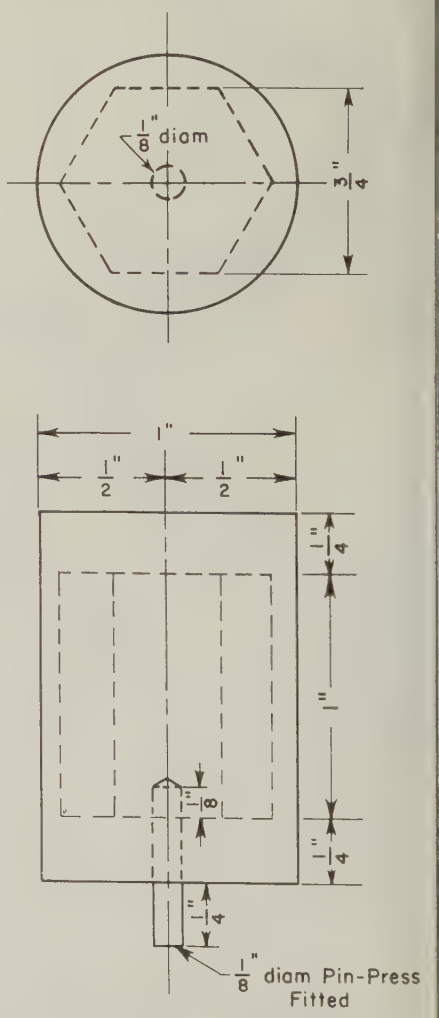

Figure 1, thermal shock test specimen. Illustration is from ASTM D1674-59T, courtesy American Society for Testing Materials.

REPORT FROM

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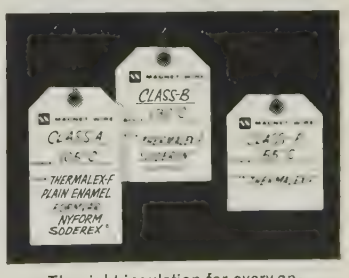
Comprehensive Data on Magnet Wire Encapsulation

A series of thermal aging tests were run by Essex Magnet Wire Laboratories to determine the compatibility of a number of magnet wires with encapsulating compounds. This data has been compiled into a test report which can be used as a guide in wire selection. Write for the complete test report or consult your Essex Magnet Wire salesman about the Essex Continuing Magnet Wire Testing Programs.



The right insulation for every application with Essex Magnet Wire

MAGNET WIRE DIVISION ESSEX WIRE CORPORATION, Fort Wayne, Indiana

Manufacturing Plants: Anaheim, Calif.; Fort Wayne, Ind.; and Hillsdale, Michigan
National Network of Warehouses and Sales Offices . . . Call Your Local "Essex Man"

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since it would not be expected to affect the compounds. A liquid is used to increase the shock. An important point is the minimum number of gallons specified since it has been shown that smaller amounts may warm up appreciably and affect results.

From the specimen shown in figure 1, it is apparent that several thicknesses of compound wall and several types of corners occur in the structure. The bar is cold drawn low carbon steel which will require little polishing if obtained from good stock. Using the specified grade of emery cloth and the cleaning solution, the bars are prepared for the mold. Only the flat portions are polished. Edges and corners should not be broken.

The method shows a suggested mold using brass or aluminum tubing with the inside slightly tapered and coated with mold release for easy removal. A bottom plate with a "Teflon" bushing to hold the pin and bar vertical is illustrated. The Teflon permits removal of the pin should any compound get into the space between bushing and pin. A shredded lead technique is shown for centering the tubing, sealing the bottom, and supporting it during casting.

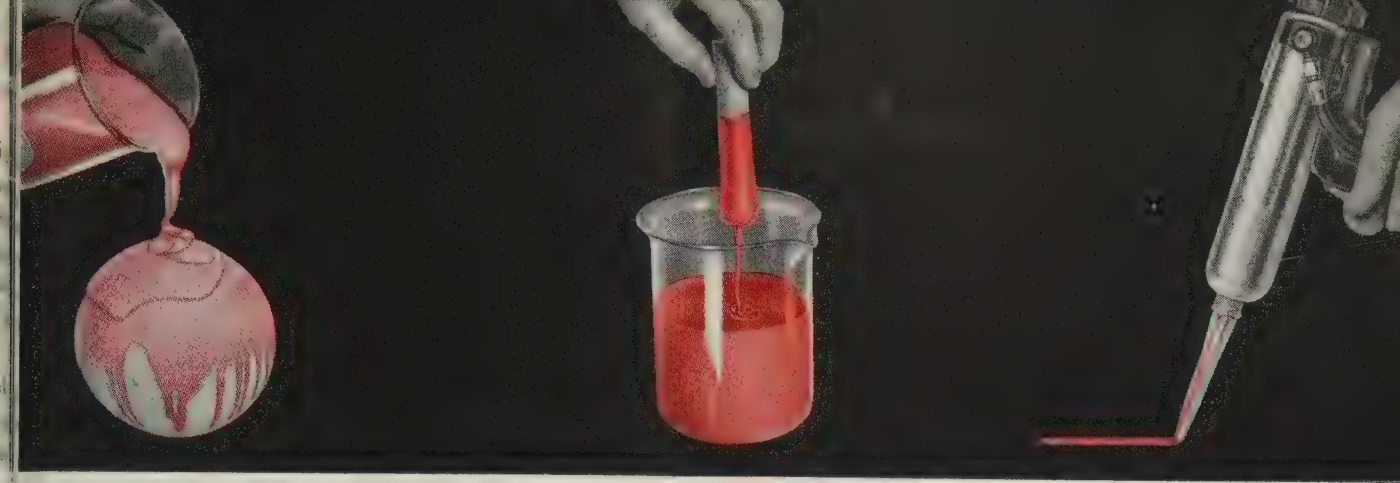
The mold assemblies are heated to 10°C above pouring temperature, and the molds are filled with the compound, taking the required precautions to exclude air bubbles. Curing is at the temperature and time specified by the manufacturer. After cooling, the specimens are pushed out of the molds.

Specimens are then placed in the oven at one of the temperatures specified in the method and held at that temperature for a time period which is sufficient to bring the compound and hex bar to the oven temperature. Specimens are then removed, quickly observed for cracks, and plunged into the alcohol bath at —55°C for the shorter time necessary to bring the mass to the bath temperature. They are then removed, quickly wiped free of alcohol, examined, and returned to the oven for the next cycle. This is continued until failure or until 10 cycles have been completed. All 10 cycles can be completed in one working day.

The report includes the curing schedule used, the oven temperature, the number of failures, and the cycles in which failures occurred. Since specimens sometimes fail at the elevated temperature, half cycles may be reported.

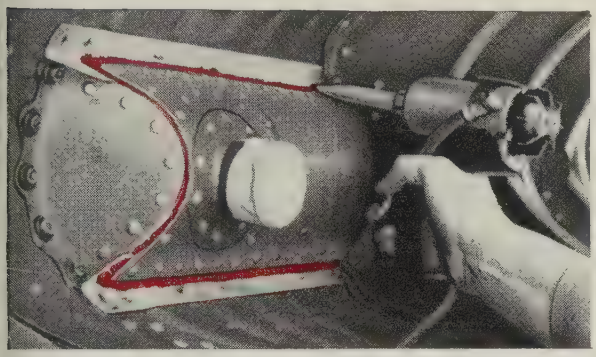
Failures show as fissures or cracks and in some cases, one end lifts off as a cap. Some specimens fail by complete shattering. There is some evidence that cracks may start internally and work has been done to detect these in opaque castings. It would appear that some of the detection methods may introduce other variables and quite probably the internal cracks will be visible externally on the next cycle.

The method does separate materials with good and poor thermal shock resistance readily. It is quite widely used and a considerable background of information on materials has been built up.



General Electric RTV silicone rubber

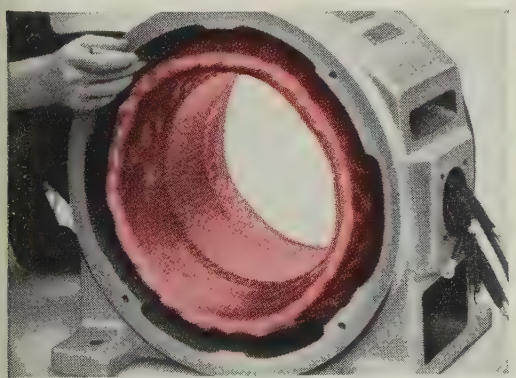
New liquid rubber cures without heat, useful from — 70 F to + 600 F, ideal for sealing, electrical insulation and flexible molds.



HEAT RESISTANT SEALING, such as shown on this Douglas DC-8 Jetliner, is made possible with RTV (room temperature vulcanizing) silicone rubber. RTV cures without application of heat; won't shrink (no solvents); forms no voids. It has excellent bond strength, plus resistance to high temperatures, moisture, weathering, ozone, aircraft fuels and solvents.

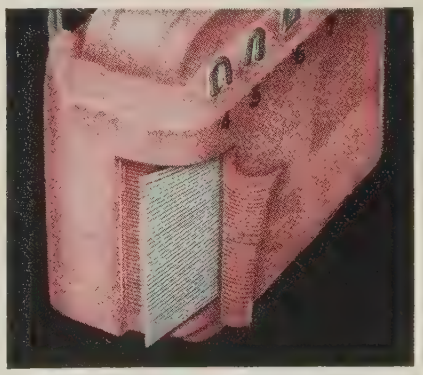
PRECISION MOLDING of prototype and engineering models and replacement parts is simplified and improved with RTV flexible mold material. G-E RTV's low shrinkage permits close tolerances and fine surface detail.

LOW-COST TOOLING with flexible RTV mold material offers added savings in time and expense. RTV's "built-in" release agent provides easy removal of this epoxy coil-winding form from mold. Total cost reduced 81%, delivery time 90%.



ENCAPSULATION OF STATOR WINDINGS, introduced by General Electric motor departments, extends service life of motors. RTV's resistance to moisture and other contaminants enables these dripproof motors to meet certain applications formerly requiring enclosed units.

POTTING OF AIRBORNE EQUIPMENT provides protection from high altitude arc-over and corona as well as vibration and moisture. RTV silicone rubber protects this cathode ray tube up to 70,000 feet.



RTV COIL IMPREGNATION enables this Hughes Aircraft Co. transformer to provide top performance at 250°. Unlike other insulations tried, G-E RTV compounds proved successful both for coil impregnation and full encapsulation.

For application data and samples of General Electric RTV silicone rubber write Section M714, General Electric Company, Silicone Products Department, Waterford, New York

GENERAL ELECTRIC

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Association News

Name Officers for NEMA Wire and Cable Division

Vernon W. Heimberger, American Steel and Wire Div., United States Steel Corp., has been elected the first chairman of the newly organized Wire and Cable Division of the National Electrical Manufacturers Association. H. W. Clough, Belden Manufacturing Co., has been elected vice chairman.

The elections took place at the wire and cable industry's recent annual convention.

At the convention it was decided to dissolve the old NEMA Wire and Cable Section of which David E. Allen, Anaconda Wire and Cable Co., was chairman; to give separate section status to the former section's six subdivisions; and to bring them and the NEMA Armored Cable Section together as a new NEMA Division.

The new sections are Magnet Wire; High Temperature Insulated Wire; Paper Power Cable; Rubber, Thermoplastic and Varnished Cable; Building Wire; and Flexible Cords.

Other members of the board are Herbert B. Bassett, The Acme Wire Co.; Howard T. Brinton, Phelps Dodge Copper Products Corp.; John R. Cook, Warren Wire Co.; J. A. Drain, National Electrical Div., H. K. Porter Co. Inc.; Herbert W. B. Farr, The Plastic Wire & Cable Corp.; A. D. R. Fraser, Rome Cable Corp.; C. W. Higbee, Electrical Conductor Div., Kaiser Aluminum & Chemical Corp.; B. F. Ilsley, General Electric Co.; R. Stuart Keefer, The Okonite Co., Sub. of Kennecott Copper Corp.; J. R. MacDonald, General Cable Corp.; Carl S. Menger, Triangle Conduit & Cable Co. Inc.; R. C. Moeller Jr., Collyer Insulated Wire Co.; Everett Morss, Simplex Wire & Cable Co.; E. L. Robinson, Crescent Insulated Wire & Cable Co.; W. J. Shea, Paranite Wire & Cable Div., Essex Wire Corp.; and James E. Sullivan, Amphenol-Borg Electronics Corp.

More NEMA News

H. L. Travis, Kelvinator Div., American Motors Corp., has been named chairman of the newly organized Consumer Products Division of NEMA. Other members of the division board are J. D. Sparks, Whirlpool Corp., vice chairman of the division; J. W. Craig, Electric Appliance Div., Westinghouse Electric Corp.; C. H. Menge, Frigidaire Div., General Motors Corp.; Judson S. Sayre, Norge Div., Borg-Warner Corp.; H. W. Schaefer, Appliance Development and Planning, Philco Corp.; William P. Von Behren, Major Appliance Div., General Electric Co.; Arnold O. Wolf, Hamilton Beach Co., Div. of Scovill Manufacturing Co.; E. L. O'Neill, The Emerson Electric Manufacturing Co.; and J. B. Ogden, Airtemp Div., Chrysler Corp.

AIEE Approves Vermont Section

The Vermont Section has been approved by the American Institute of Electrical Engineers. The new section, the 115th in the 52,000 member organization, was formerly a subsection of the Pittsfield (Mass.) Section and has about 50 members.

Officers are the same as the officers of the previous Vermont Subsection: H. A. VanDine Jr., chairman, and G. H. Howland, secretary.

Pre-Planned Sessions, Seven Field Trips Highlight WESCON

The technical program of the Western Electronic Show and Convention will contain pre-planned technical sessions on as many as 10 special subjects, including a whole series of meetings on "Man-Machine Systems." Seven field trips to sites of outstanding technical interest also have been scheduled during the four-day affair in Los Angeles, August 23-26.

Hundreds of technical papers were reviewed in making selections for the technical convention, and these will be augmented by several sessions for which selected authors were invited to participate. Format for these sessions will vary, including debates, colloquia, and more formal programs.

For the first time, a women's session will be included in addition to other women's activities planned on a "Polynesian Holiday" theme. The session is intended to examine some of the factors affecting the technical man "away from the job."

The trip schedule includes: Jet Propulsion Laboratory and California Institute of Technology (both Pasadena); Space Technology Laboratories (developmental laboratories for earth satellites and space probe vehicles); Packard-Bell Electronics and Telemeter Magnetics Corp. (both West Los Angeles); System Development Corp. (Santa Monica); Rocketdyne Division of North American Aviation Inc. (Chatsworth); Radio Corp. of America and Thompson-Ramo Wooldridge (both West San Fernando Valley); International Telephone and Telegraph, Librascope Division of General Precision, Computer Measurements (Glendale-Burbank); and the Hughes Aircraft research laboratories (Malibu).

Expect 600 Participants in Distributor-Rep Conference

Wescon's sixth annual Distributor-Representative Conference is expected to attract more than 600 persons to the Ambassador Hotel, Los Angeles, on August 22. Distributors, factory sales managers, and sales representatives from throughout the West will get together for business discussions a day ahead of WESCON's official opening.

U. S. in International Work on Standard Quantities and Units

The U.S. is being represented at an international standards meeting concerned with standards for quantities, units, symbols, conversion factors, and conversion tables. Harald H. Nielsen, Chairman of the Dept. of Physics and Astronomy, the Ohio State University, and Guy Waddington, Director, Office of Critical Tables, National Research Council, Washington, D.C., are the ASA delegates at the meeting of Technical Committee 12 of the International Organization for Standardization in Copenhagen, Denmark, June 28 to July 2.

The trick is in the adhesive. CDF's Di-Clad® printed circuit boards are tested for bond strength in this precision machine.

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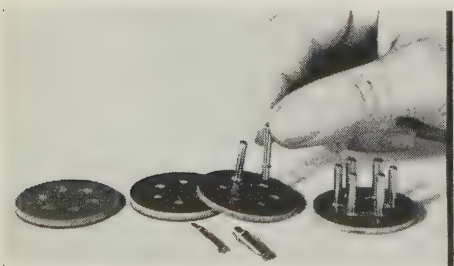
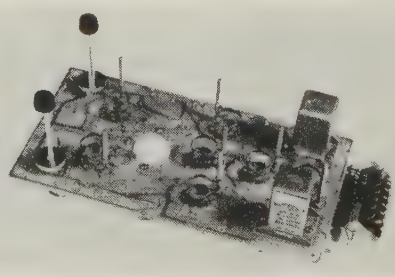


Vibration-free plug bases, fabricated by CDF. A special bond of CDF Dilecto laminated plastic and rubber.



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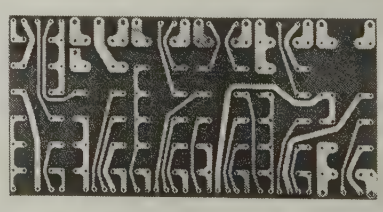

Low-Cost commercial circuits. Made from CDF's paper-based Di-Clad copper-clad laminate.

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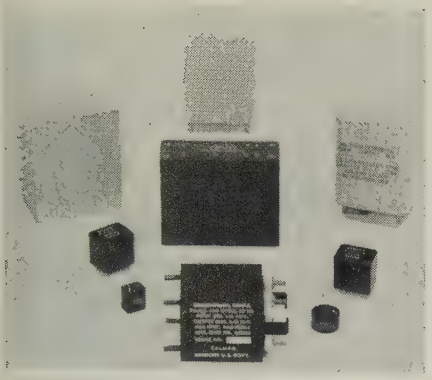

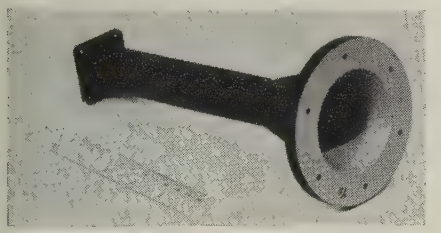

Safety Considerations In Handling Encapsulants

By John Delmonte, General Manager, Furane Plastics Inc., Los Angeles.

During the past few years, the encapsulation of electrical and electronic components has been accepted widely by individuals responsible for electrical insulation. Among the important reasons for this are:

1. Protection of components from exposure to harmful environments.
2. Miniaturization of assemblies through the integration of components and elimination of extra "hardware."
3. Protection from mechanical abuse.
4. Improved heat dissipation through the use of a solid dielectric rather than dead air space.
5. Neater, coordinated package with greater eye appeal.

Materials Used

The better known encapsulants are prepared from polyester, epoxy, and polyurethane resin formulations. The epoxy resin formulations are the most prevalent and many of the comments on safe handling procedures are based on industry experiences with this class of materials.

Typical chemicals involved in the use of electrical/electronic encapsulation procedures are:

1. Release Agents—solvent systems of waxes, lecithin, or silicones are used to coat molds or surfaces where release is desired. Solvents used are typically aromatics, such as toluene or xylene.

2. Epoxy Resin Formulations—generally comprised of two components, the resin system and the hardener or curing agent. They are combined to form a reactive mixture capable of fulfilling the functions of the encapsulant.

3. Clean-Up Chemicals—solvents such as toluene or methyl ethyl ketone are used for clean-up purposes on molds, tools, work areas, etc. Chlorinated solvents are sometimes used to salvage components from cured materials.

Generally, these chemicals and plastics are handled by individuals whose backgrounds may involve electronic assembly measures. While a few major plants have engaged personnel with appropriate chemical backgrounds to supervise the handling of such materials, many smaller establishments have turned the responsibility over to uninformed individuals. It is important that organizations be alerted to the functions and handling qualities of the encapsulants.

Curing Agents, Diluents, and Fillers

Selection of safe materials consistent with the performance requirements for the encapsulant is one measure to consider. Epoxy resin formulations come in many guises—hard and soft, room temperature and high temperature curing, filled and unfilled, long pot life and short pot life. Prominent among the more rapidly curing systems at room temperature are the amine curing agents, such as diethylene triamine or triethylene tetramine and their resin adducts. These compounds are notorious as primary skin irritants. They have been superseded to some extent by more recent safety hardeners for epoxy resins, such as Furane's hardener 9810 and 9816 which are functionally equivalent to d.e.t.a. or t.e.t.a. There is no technical justification for the toxic hardeners when safety hardeners are available. The safety hardeners possess a very low incidence of skin irritation and are qualified by suitable patch tests.

Higher temperature cures may involve aromatic amines such as meta phenylene diamine as the curing agent. These materials stain hands and clothing. While some systems will require these compounds, it should be noted that liquid anhydride systems are available which are functionally equivalent and safer to handle.

A few epoxy formulations are modified with reactive diluents which may create handling problems. Although high molecular epoxies from bisphenol-A and epichlorohydrin are considered "safe," lower molecular weight, liquid grades, and some of the newer diepoxides must be handled with greater care. To make these formulations effective for electrical/electronic encapsulation, they may be combined wtih fillers such as finely divided silica, mica, asbestos, or talc, the dusts of which are harmful. Commercial epoxy resin formulators know and use the proper safety measures when formulating these compounds—thus, it is best not to add formulating responsibilities to the burdens of the electronic manufacturers.

Protective Measures

Clean-up procedures should receive more than passing attention. The usual tendency on the assembly line when using resin encapsulants is to provide copious quantities of solvents for clean-up purposes. They are, in most instances, too effective. We may assume that proper storage has been provided in accordance with fire regulations for flammable liquids. The problems arise when the cleaning solvents are employed for washing hands, at which time natural protective oils in the skin are removed, and the individuals become much more sensitive to exposure to the resin formulations and their hardeners. In fact, many causes of skin irritation and rashes have been traced to over-fastidiousness on the part of individual employees using clean-up solvents. There does not appear to be a good substitute for ordinary soap and warm water for cleaning resin chemicals from the hands.

The use of protective hand creams should be encouraged. In our laboratory, where frequent contact with resin chemicals takes place, we have found them effective. When washed off, they should be replenished faithfully. However, the employee should not be lulled into false security when handling chemicals known to be dangerous and toxic. Rubber gloves must be worn. Likewise, if prolonged contact with the resin encapsulants may occur, protective wearing apparel as well as rubber gloves are recommended.

Harmful Consequences

Assuming that the safety measures previously suggested are not observed, some of the harmful consequences of handling encapsulating materials are:

1. Skin irritations—rashes or eruptions break out on exposed skin, accompanied by itching—this usually starts on hands and arms when non-safety curing agents are used. If high vapor pressure curing agents are present, skin irritations may occur on the face and eyelids.
2. Dermatologists point out the existence of a threshold tolerance for some amines used to cure epoxies, or for reactive diluents, such as allyl glycidyl ether. Individuals may exhibit apparent resistance to a point. After this has been reached, subsequent exposures will bring on irritating effects more rapidly and at lower concentrations of harmful vapors.
3. Psychosomatic symptoms are demonstrated by some individuals when confronted with the complex chemicals used in resin encapsulation.

Recommendations

Measures which may be followed to assure safe handling of resin encapsulants are as follows:

1. Specification of "safety" systems which are functionally acceptable to the operator and meet the design requirements of the electronic or electrical components.
2. Employee education in safe handling of materials is quite important. Particular emphasis should be placed on personal cleanliness. Resins and chemicals should not be wiped on clothing or left in a sloppy condition on work areas. Wiping rags for clean-up should be available, as well as buckets for quick disposal.
3. Good ventilation is desirable, particularly in areas where materials are mixed or where they are spread over large surfaces such as in laminating. Ventilation is also a primary consideration for ovens in which curing takes place and volatiles are given off as well as in handling any materials with high vapor pressure or with high exotherms which create vapors and volatiles.
4. Rubber gloves and protective wearing apparel (including safety glass when mixing chemicals) are important. Employees should wear rubber gloves when handling encapsulants of unknown safety qualities. When materials are safe (non-irritating to the skin), protective hand creams should be used.
5. Clean-up at the end of work periods is important. Soap and water should be used on the hands rather than cleaning solvents.

Production managers and engineers for manufacturers of electrical and electronic components have accepted resin encapsulants because of their many advantages. The adoption of adequate safety measures will permit continued and effective use of these materials.

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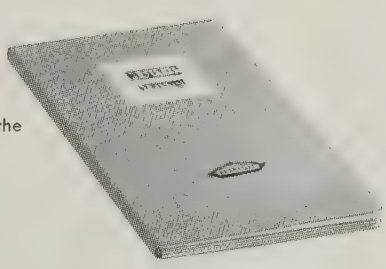

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Formulation by Users, Evaluation Methods Uncovered by Solidifying Fluid Survey

In the previous two issues, *Insulation* described a reader survey which dealt with solidifying fluid insulations —those electrical insulation materials which are used or applied in a fluid form and which are subsequently converted to a solid, film, or foam form. More commonly, these materials would be called varnishes, enamels, resins, waxes, potting compounds, etc., but such terms were avoided in the survey to prevent prejudicing of the results.

A total of 2,994 individuals, each at different plants, received the survey questionnaire—893 were returned for a response of 29.83%. Of these, 787 or 88.13% were considered usable and of the 787, there were 589 or 74.8% of the respondents who indicated that their plants used solidifying fluid insulations. In the previous two issues, some of the improvements desired in materials and in processing of materials, equipment for processing possessed by users, applications, and attitudes toward suppliers, as uncovered by the survey were discussed. In this issue, formulation by users, materials to be evaluated, and methods of evaluation are described.

Formulation by Users

Users were asked if their companies formulated solidifying fluid materials for their own use. They had the opportunity of checking "yes" or "no" answers. As shown in table 1, the great majority of users do not do their own formulating. However, the fact that nearly one out of every five users in the industry does formulate solidifying fluids is significant. As a check on the answers to the preceding question and to determine whether the questionnaires were being answered accurately, users in another part of the questionnaire were asked if their companies had established formulating departments for solidifying fluids. As would be expected, the answers closely paralleled the answers to the preceding question with the exception that a very slight percentage of those firms doing their own formulating did not actually have established departments for such formulating.

Solidifying Fluids Recently Or Soon to be Evaluated

Users of solidifying fluid insulations were requested to list materials recently investigated or materials they planned to investigate in the near future for possible use in their products. Of the 589 users responding to the questionnaire, 241, or 40.9%, listed such materials.

Of the 241 users who listed materials, 144 (59.7%) or well over half, listed various epoxy materials including just about every type of epoxy compound, varnish, resin, foam, etc. for potting, encapsulation, sealing, bonding, heat conductivity, flexibility,

Table 1—Number and Percentage of Users Formulating Their Own Solidifying Fluid Materials
*Number of Mentions and Percentages per Product Code**

Product Code	Yes		No		Total Replies	
	Number	%**	Number	%**	Number	%**
A	15	13.0	100	87.0	115	100.0
B	47	20.8	178	79.2	225	100.0
C	17	22.0	60	78.0	77	100.0
D	13	24.1	41	75.9	54	100.0
E	3	17.7	14	82.3	17	100.0
F	12	14.0	74	86.0	86	100.0
G	17	24.7	52	75.3	69	100.0
H	21	19.4	87	80.6	108	100.0
I	21	15.5	114	84.5	135	100.0
J	17	19.3	71	80.7	88	100.0
K	10	11.6	76	88.4	86	100.0
L	3	6.7	42	93.3	45	100.0
M	1	16.7	5	83.3	6	100.0
Actual Mentions	89	16.3	456	83.7	545	100.0

(Of 589 users 44, or 7.5%, did not answer the question)

*A—Motors, generators, and parts (manufacturing or repair)
B—Transformers, coils and related devices and parts
C—Insulated wire and cable
D—Wiring devices, connectors, etc.
E—Household and commercial appliances
F—Switchgear, controls, relays, circuit breakers, switches, parts, etc.
G—Printed circuits
H—Electronic components and parts (tubes, capacitors, resistors, semi-conductors)
I—Electronic and communication apparatus and assemblies
J—Aircraft and missile parts and equipment
K—Instruments and test equipment
L—Electrically or electronically controlled, operated, or powered tools and machines
M—Other
**Percent of total answering for each group

Table 2—How Users Evaluate Solidifying Fluids

Product Code*	Users Answering	Actual Components or Equipment		Recognized Test Models		Test Devices of Own Design		None	
		No.	%**	No.	%**	No.	%**	No.	%**
A	98	84	85.7	20	20.4	30	30.6	3	3.1
B	210	171	81.4	44	20.9	59	28.1	3	1.4
C	68	56	82.3	20	29.4	22	32.4	1	1.5
D	50	36	72.0	14	28.0	20	40.0	2	4.0
E	13	13	100.0	4	30.8	5	38.5	—	—
F	75	61	81.4	13	17.3	22	29.4	2	2.7
G	66	48	72.7	17	25.8	25	37.9	1	1.5
H	99	85	85.8	26	26.3	29	29.3	2	2.0
I	120	98	81.7	25	20.8	30	25.0	3	2.5
J	78	70	89.7	25	32.1	31	39.7	—	—
K	80	63	78.7	11	13.7	25	31.3	2	2.5
L	37	34	91.9	9	24.3	12	32.4	—	—
M	5	4	80.0	1	20.0	2	40.0	—	—
Actual Mentions	499	416	83.3	98	19.6	150	30.1	12	2.4

Users mentioning more than one evaluation method—147
(Of 589 users 90 or 15.3% did not answer the question)

*A—Motors, generators, and parts (manufacturing or repair)
B—Transformers, coils and related devices and parts
C—Insulated wire and cable
D—Wiring devices, connectors, etc.
E—Household and commercial appliances
F—Switchgear, controls, relays, circuit breakers, switches, parts, etc.
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K—Instruments and test equipment
L—Electrically or electronically controlled, operated, or powered tools and machines
M—Other
**Percent of users answering for each group.

molding, splicing, casting, fluidized bed processing, heat resistance, embedment, room temperature curing, etc.

Many of the users who listed materials mentioned silicones. The actual number of respondents listing silicones was 78 or 32.3%. The various silicones listed included resins, enamels, rubbers, pastes, foams, molding compounds, potting compounds, varnishes, and dielectric gel.

There were 24 mentions or 10% for polyurethane materials, including foams, potting compounds, casting materials, elastomers, and coatings.

Polyester foams, compounds, and resins received 16 mentions or 6.6% of those users listing materials to be investigated.

Naturally, there were numerous other materials which could not readily be classified. For example, many were listed according to the type of use and some according to the technique of application.

Among the other products mentioned in rather large numbers were various cements, adhesives, sealers, fillers, phenolic resins, flexible resins, waxes, water soluble materials, wire enamels, casting ceramics, low melting glass, ceramic solutions, high temperature materials, quick setting varnishes, low loss potting compounds, plastic materials, styrenes, "Kel-F" dispersions, alkyds, foams, "Teflon" emulsions, "Thiokols," polyvinyl compounds, elastomers, plastisols, liquid polybutadienes, etc.

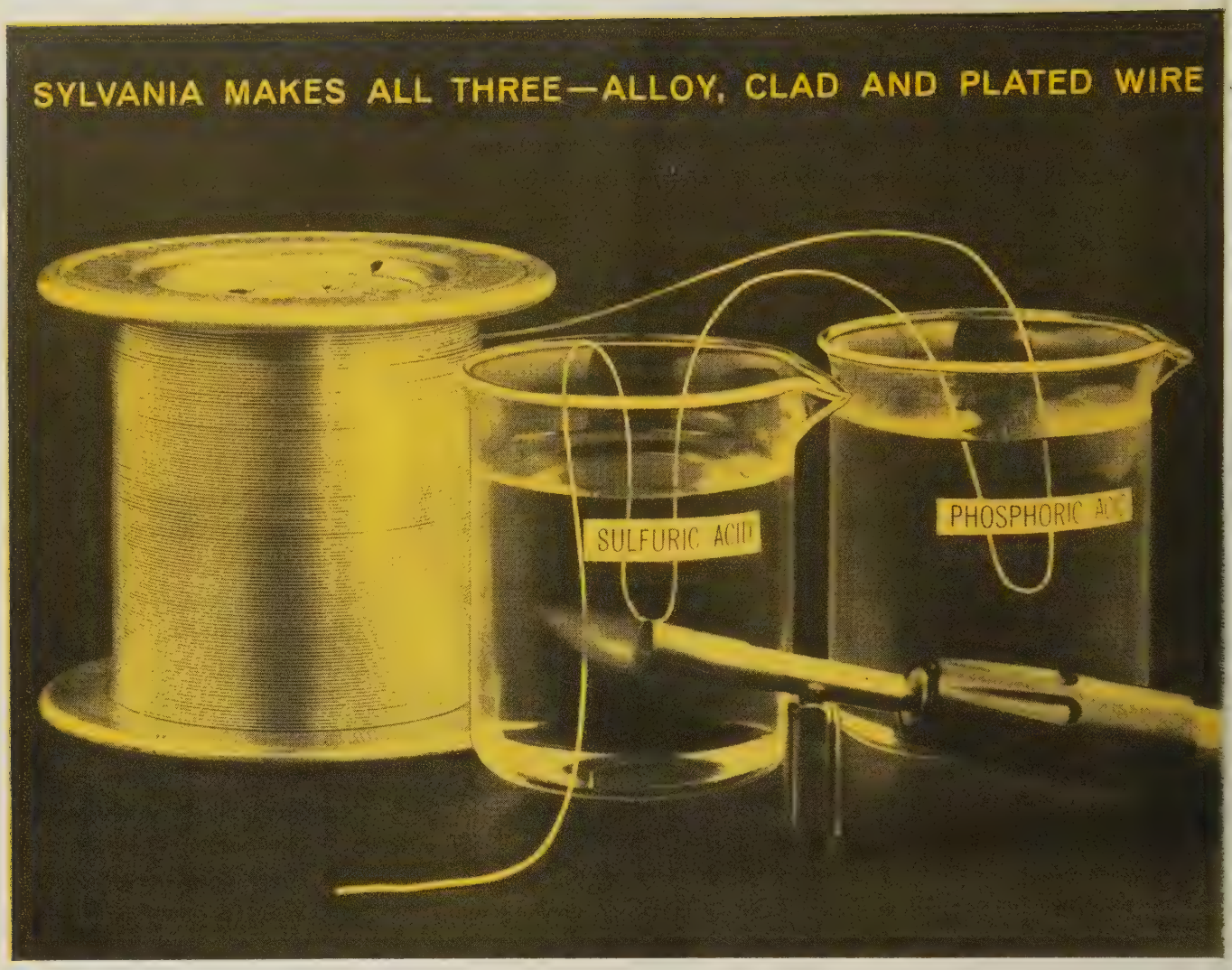
Methods of Evaluating

In connection with their investigations of new solidifying fluid insulations, users were asked how they evaluated these materials. Answers were provided by checking one or more of the following choices: (1) actual components or equipment, (2) recognized test models, (3) test devices of own design, and (4) none.

As shown in table 2, 499 users answered this question or 84.7% of the users who returned questionnaires. Naturally, to a limited extent it might be assumed that some of the users who did not answer the question actually do no testing and might be classified under "none." Table 2 shows the numbers and percentages for the actual totals as well as according to type of product manufactured by the user. By far the most popular method of evaluation is that involving tests on actual components or equipment. To some degree such testing must be performed on most components or equipment as a part of the manufacturing process. It is not possible to determine whether or not components or equipment made with new solidifying fluid materials are subjected to exhaustive and thorough laboratory testing.

It is interesting that for most products, only one out of four or five indicated that tests were made on recognized test models. Naturally, much depends on one's definition of a recognized test model but regardless, the figure is surprisingly low in view of the emphasis of recent years on standardized test methods and test models or equipment. As a matter of fact, it is unusual that more users use test devices of their own design than recognized test models for evaluation. In some cases this would make valid interlaboratory comparisons extremely difficult.

It is encouraging to know that an extremely small number of users indicated that they did not evaluate new solidifying fluid insulations at all.



New Sylvania nickel-clad silver 20% wire passes the acid test—beats the heat

—another reason why Sylvania gives unbiased recommendations on wire

New Sylvania nickel-clad silver 20% wire has all these outstanding properties: excellent electrical conductivity, corrosion resistance superior to silver wire, ability to withstand temperatures up through 1500°F. As a result, it's ideal for electrical hookup wire where conditions call for critical service, long life under oxidizing, corrosive or high-temperature environments.

This new wire is available from .005″ to .125″ diameter, in a variety of tempers from dead soft to full hard.

It is another example of how you can simplify your design and specification problems by getting a Sylvania recommendation on wire. Sylvania knows wire, knows the particular advantages of each kind. In fact, of all major manufacturers, only Sylvania makes all three types of bare wire—alloy, clad and plated.

Why not get full details and timesaving technical assistance today. Simply write Sylvania Electric Products Inc., Parts Division, Warren, Pennsylvania.

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Print Ins. 29 on Reader Service Card

New Plastic Blending and Distribution System Cuts Costs and Aids Quality Control in Wire Insulation Processing

By David Barr, Plant Engineer, and M. M. Orend, Project Engineer, Plant Engineering, National Electric Div., H. K. Porter Co.

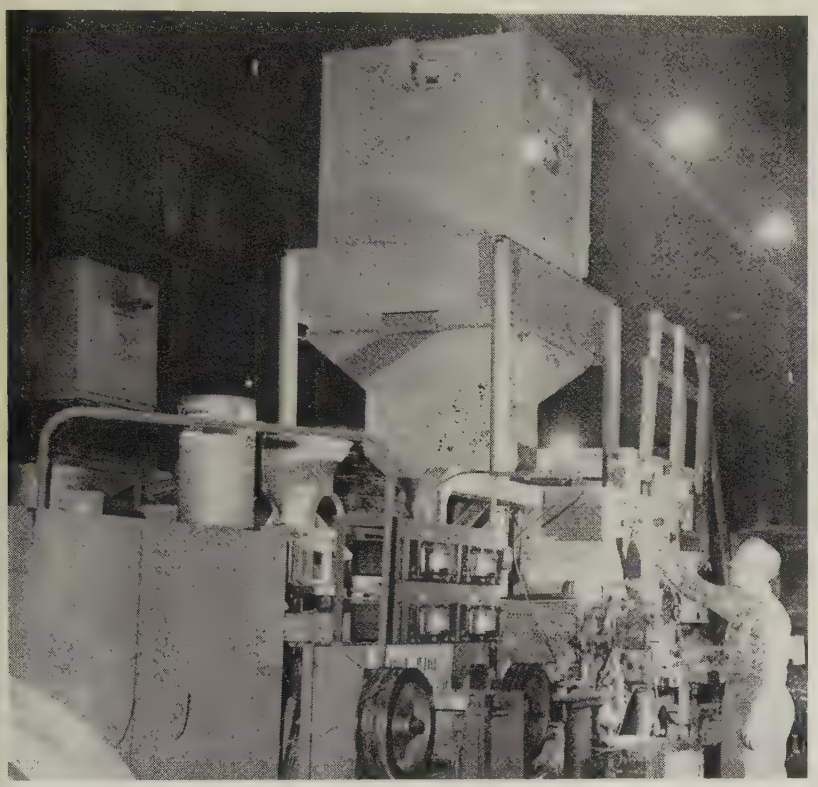


Figure 1, natural PVC is fed from hopper at top center of photo to conveyor. Color chip feeder is funnel-shaped unit at left center.

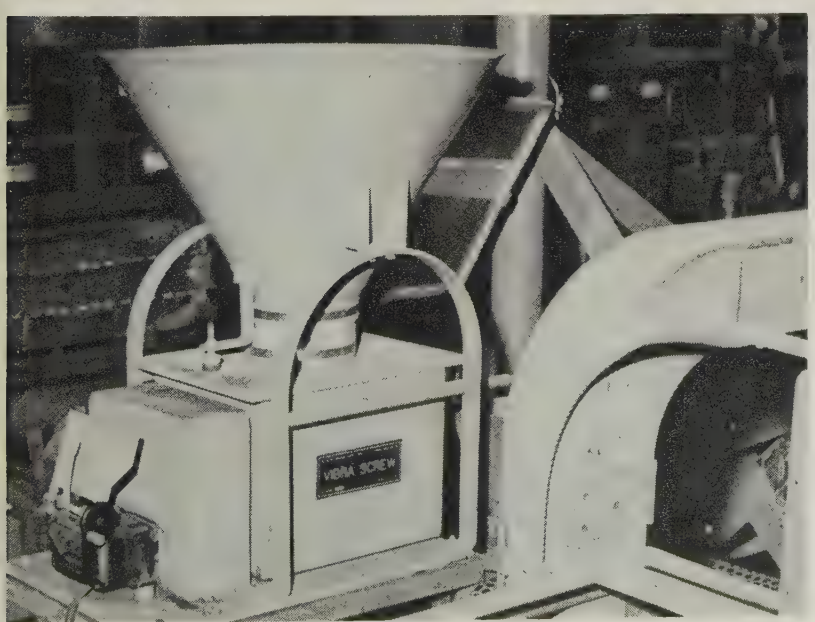


Figure 2, Vibra Screw color chip feeder.

Important dollar savings, better production, and greatly enhanced quality control in the manufacture of plastic insulated wire and cable are among the improvements recently realized at the Ambridge, Pa. plant of National Electric Div., H. K. Porter Co. Six dry materials feeders for metering color chips have been added to the plastic extrusion department and the company has engineered and installed a distribution system connecting the blending plant to the extruders.

Among the many types of wire and cable manufactured by National Electric is TW—a waterproof thermoplastic building wire produced in sizes from No. 14 to 500 MCM. The insulation on this wire is polyvinyl chloride, extruded in natural, black, and a variety of colors onto the electrical conductor moving through a cross-head extruder.

Coloring PVC

Polyvinyl chloride (PVC) may either be purchased already formulated or the wire producer may purchase the resins and other ingredients and make his own mix. At the Ambridge plant, PVC is produced in powdered form in a ribbon blender on the factory grounds. Three different formulations, each in natural and black, are made. Required colors conforming to NEMA standards are obtained by adding color chips to the "natural" PVC prior to feeding the batch into the extruder.

These color chips are small bits of varying size and color concentration which, in units of one pound, will always be found to possess a fixed concentration. For example, the color standard specified to produce a specific tint in the plastic insulation re-

quires the distribution or addition of 1 lb of color chips to 100 lbs of PVC —or a concentration of 1%. The chips are a dispersion of an organic dye in a low molecular weight vinyl co-polymer. In this form the chips are chemically similar to PVC, thus assuring good color dispersal when the chips are fused with the PVC, under heat, in the extruder.

Previous System

About a year ago the company re-examined its system of moving PVC from blending mill to extruders and its method of introducing color chips into the PVC, with the object of increasing production efficiency, reducing costs, and improving color uniformity.

To better understand this situation and the effect of the solutions later adopted, let's look at the system as it then existed.

The blending plant was approximately 1000 feet away, by a circuitous indoor route, from that portion of the plant devoted to extruding plastic insulation. When the extruder operator needed PVC to feed his machine. he phoned the mill and specified the formulation and color needed. If a color other than natural or black was ordered, the mill personnel simply opened a drum of natural PVC and, by hand, dumped in an amount of color chips approximating the required concentration . . . and the tendency was always to be overgenerous. A standard 250-lb drum of PVC was then trucked to the extruder. If color chips had been added, a workman then attempted to mix the batch by tumbling the drum on a machine designed for this purpose. The drum was then lifted to a platform above the extruder where the contents were fed by shovel into a 750-lb capacity hopper.

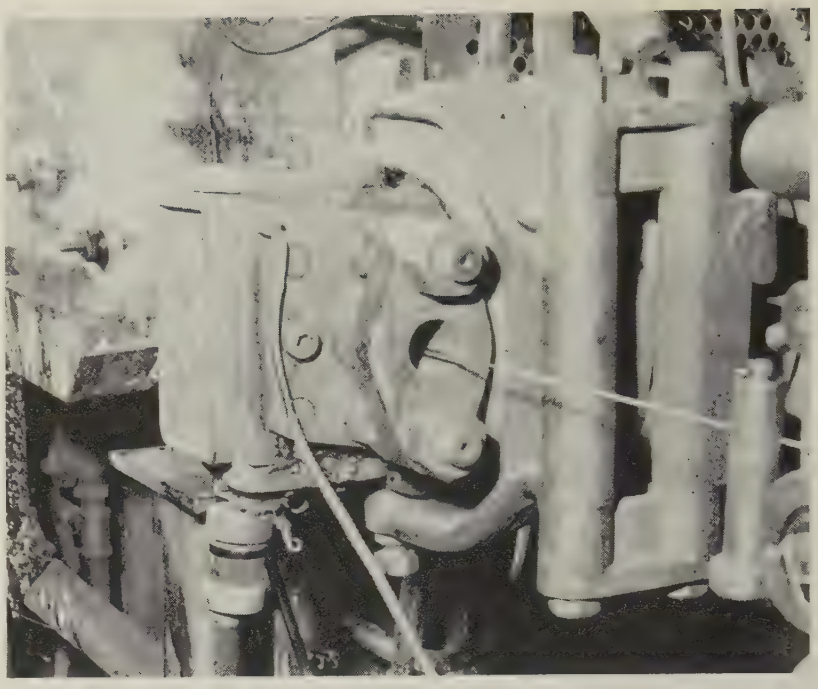


Figure 3, extruder.

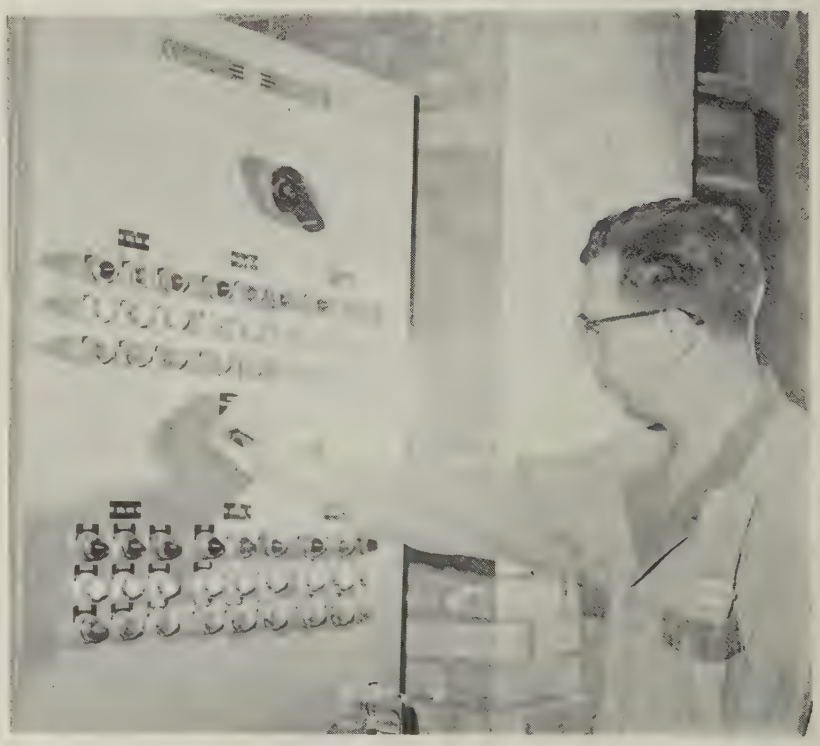


Figure 4, master control panel in blending plant which registers orders for material from each extruder.

Problems

What were the consequences of and the problems perpetuated by this procedure? First, time and manpower were expended in hauling PVC between mill and extruder, in tumbling the drums, and in shoveling PVC from drum to hopper. This shoveling operation also resulted in lost PVC through spillage. Second, the overabundant measurement of color chips was found to be adding to each batch as much as one-third more chips than the amount needed to meet the specified color standards. This meant wasted dollars and, equally important, resulted in an unwanted color concentration which produced the wrong tint. Third, this method of adding and mixing the chips sometimes resulted in uneven, non-uniform distribution of color in the mass of PVC moving into the extruder—resulting in spotty tint and fadeouts. Simultaneously, this uneven mixing caused

uneven dielectric strength in the insulation. Finally, there was no way to assure the same even, uniform tint from reel to reel, from one day to the next—a requisite in colored, insulated TW cable.

Color Quality Control

Initial study was directed to the most critical problem—color quality control. A device was required which would replace adding of the chips by hand and add only the required amount, at the speed and concentration desired. It was quickly concluded that the most efficient point of adding color would be at the extruder line. just before the natural PVC entered the extruder.

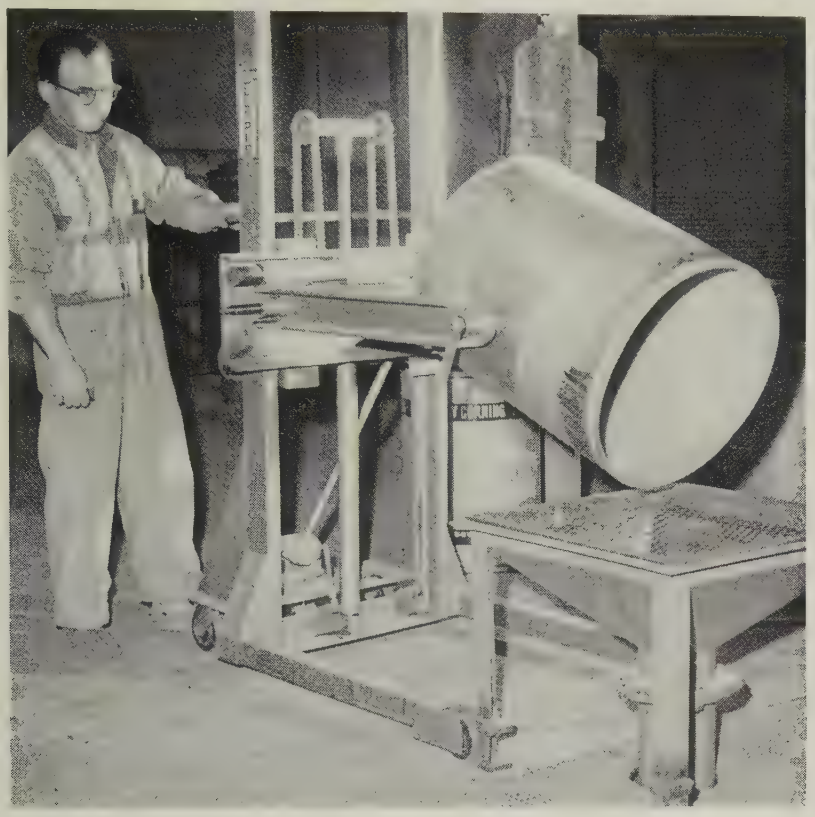


Figure 5, intake feed hopper in blending plant.

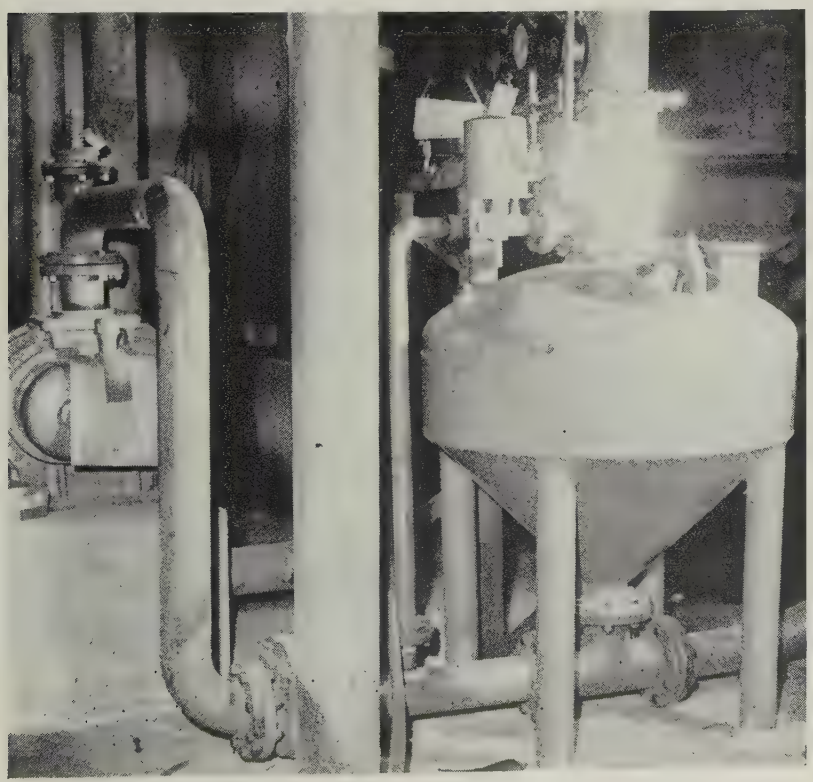


Figure 6, activator unit on right in blending plant. Rotary pump is on left.

Color Chip Feeder

The problem was discussed with the color chip manufacturers and six Vibra Screw volumetric feeders were selected and installed to solve part of the problem. Metering by volume, this feeder supplies a predetermined amount of dry material to a batch either continuously or by programmed cycles. The feeder employs density control along with volumetric metering and uses vibratory flow to assure complete filling and emptying of the measuring elements. Design eliminates the danger of air entrapment rendering volumetric measurement inaccurate, and permits a dust-free operation without the usual bridging or packing of low-bulk powders.

The measuring element is a screw that provides continuous volumetric measurement. The entire machine is continuously vibrated. In each cycle the vibration completely fills the screw with material. The screw is then completely emptied to provide an unvarying volumetric measure for each cycle. Speed and feed settings are made by micrometric adjustment, dial-calibrated to 400 divisions.

Extrusion Process

In the extrusion process, natural PVC is fed from a hopper at required rate and volume onto a vibrator-operated conveyor. Below this hopper and directly above the conveyor is the feeder. with the mouth of the screw directly in line with the moving stream of PVC.

The selected color chips are loaded into the hopper of the feeder. Micrometer adjustment controls are set for desired speed and density of flow. The chips flow smoothly from the upper hopper, dropping to a surge hopper which forms the trough of the screw. Vibration causes the chips to fill the screw flight completely, at a constant bulk density. The result is that with reproducible density and filling, the

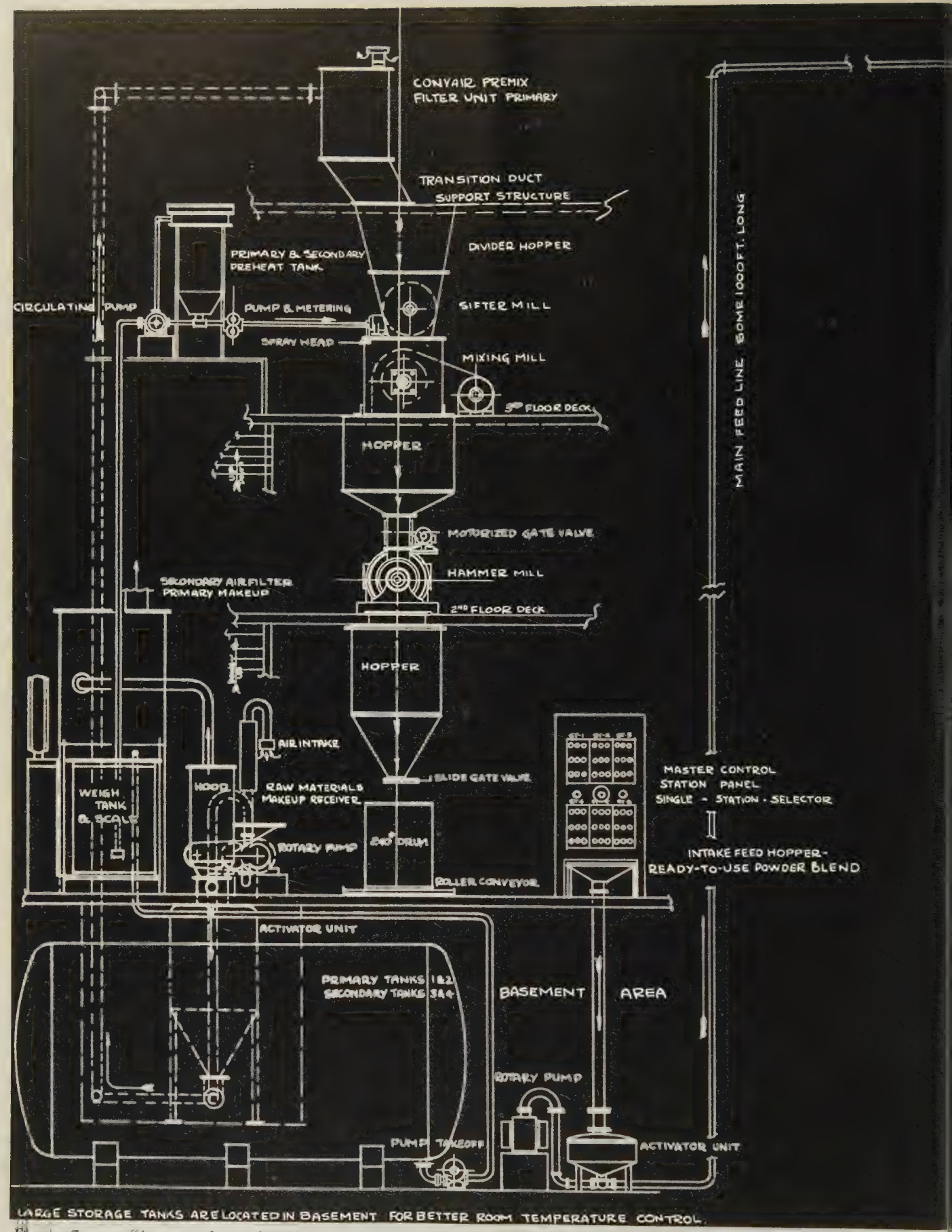
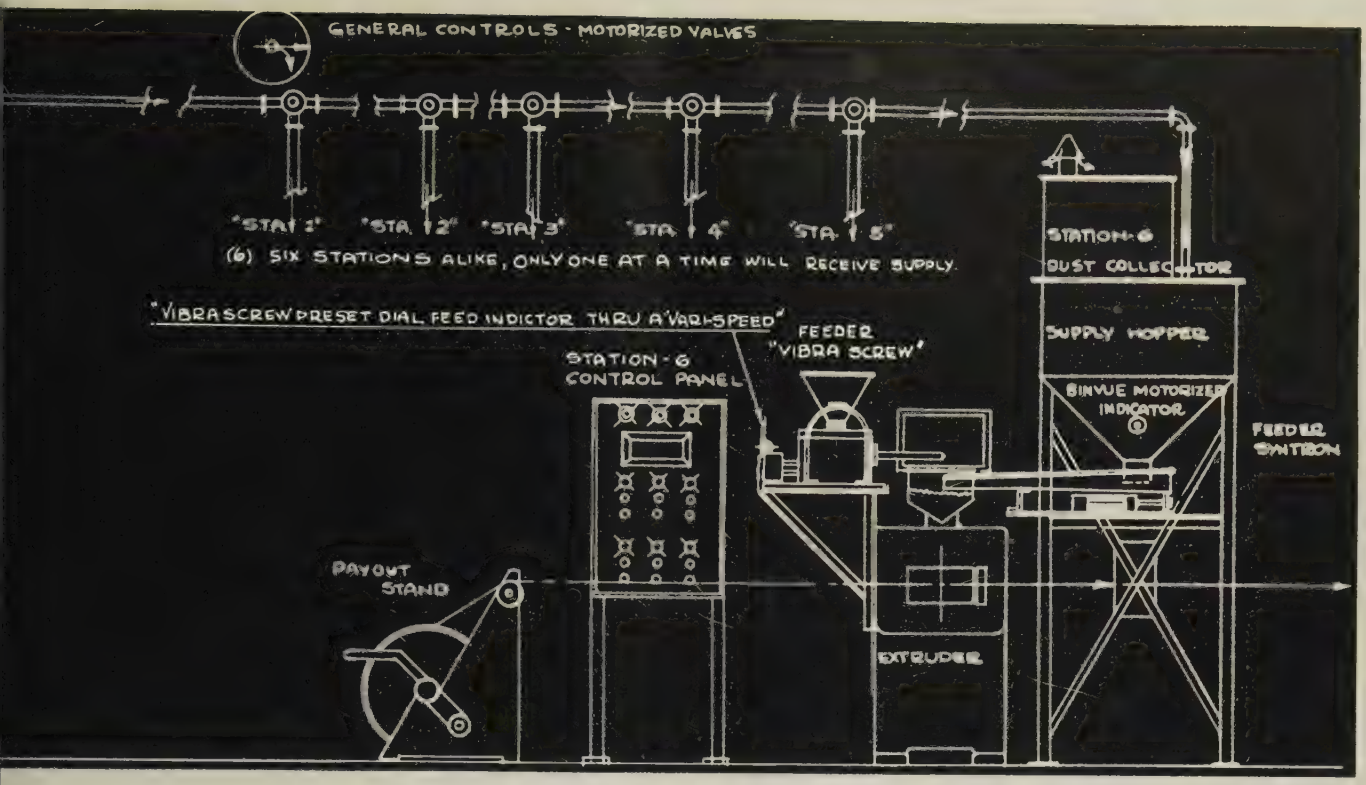


Figure 7, new "integrated powder blend distribution system" which will deliver one of three required PVC formulations to each of six extruders at six stations. A 30-hp blower will propel 250 lbs. of PVC through 900 feet of pipe in less than 1½ minutes. A signal panel at each extruder (see next page) allows the operator to signal to the blending plant the specific formulations desired.



screw speed provides control of the feed rate, adding a precisely accurate volume of chips at a desired rate to the PVC.

The PVC powder blend, with color chips moving along in proper distribution, is conveyed into the extruder, exposed to heat, fused into a colored plastic mass, and applied under screw pressure to the cable. The cable then passes through a die with its already hardening plastic insulation cover, passes through cooling troughs, and eventually is wound onto take-up reels.

Color Chip Feeder Advantages

In the first year of operation the six Vibra Screw feeders permitted a saving in chips and handling of $5,102, against an initial equipment and installation cost of $4,112. The equipment pay-off was met in 10 months, with nearly $1,000 left at year-end. Conservative estimates point to annual savings of over $5,000.

In addition, the tumbling operation has been eliminated, reducing manpower cost. What's more, efficient control over color density, through better distribution of chips and accurate feeding of the exact 1% per 100 lbs PVC, assures uniformity of color.

Also, controlled distribution of chips aids in maintaining a uniform dielectric strength in the insulation. And the company laboratories have been able to enforce color standards which assure uniform tint from reel to reel and order to order.

Powder Blend Distribution System

After successfully solving the color control problem, the plant engineering staff turned its attention to improvement of the method of moving PVC from the blending plant to the extrusion plant. Nearing completion today is a $40,000 project which will result in what we are calling an "integrated powder blend distribution system." This system has been engineered by the Lombard Corp. of Youngstown, Ohio, in conjunction with the plant engineering staff of National Electric. Essentially it is a Convair conveyor system of the self-cleansing type.

As before, the resin will be batched into powder form in the blending plant and stored in 250-lb drums.

The new system will deliver one of three required PVC formulations, in black or natural, to each of six extruders at six locations, these extruders ranging in screw size from 2½" to 6". Heart of the distribution system is a 4" diameter pipe running from the blending plant through the factory by the shortest direct overhead route to the hoppers over each of the extruders. A 30-hp blower will propel 250 lbs of PVC through the 900 feet of pipe in less than 1½ minutes.

A signal panel at each extruder allows the operator to signal to the blending plant the specific formulation desired. A master control panel at the plant will register these orders for material from each extruder. The plant can also signal the extruder that the order is being filled.

Increased speed of handling, elimination of trucking, manpower savings, and elimination of waste in loading hoppers by shovel are obvious benefits to be derived from the new installation.

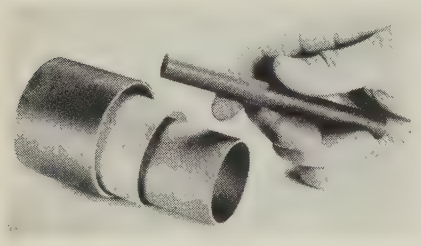
With the six Vibra Screw feeders integrated into the over-all production process, and the new PVC distribution system installed, we think we have taken important steps to effect material and labor economies, to increase production efficiency, and to improve color quality control.

New Products

For further information on these products print the item number on the Reader Service Inquiry Card on the back cover. Fill out and mail the card—no postage is required. Insulation *will immediately forward your inquiry to the manufacturers concerned so that they can send you more information promptly.*

Epoxy-Glass Rolled Tubing With NEMA G-11 Properties

New rolled epoxy-glass tubing is stated to have the superior electrical and physical properties required of NEMA G-11 sheets. Known as "Dilecto" GB-125EFR, the tubing is made from epoxy resin impregnated glass cloth that is rolled and cured on



mandrels. It is designed for use in transformers, other heavy electrical equipment, and military electronic equipment. Excellent physical properties, flame retardance, arc resistance, and high flexural strength at 150°C are reported. Continental-Diamond Fibre Corp., Newark 17, Del.

Print No. Ins. 101 on Reader Service Card

New Multi-Purpose Magnet Wire For Class A Through F Use

New "Poly-Thermaleze" is a multipurpose magnet wire recommended for class A through F uses. Physical, thermal, electrical, and chemical properties are claimed to be equal to or better than any of the organic film wires currently available for coils, motors, and transformers other than oil filled. It is stated to be one of the most significant magnet wire developments of recent years. Suggested applications include use in stator-wound induction motors (ranging from fractionals to integrals), d-c field coils and armatures, any and all kinds of transformers except oil filled, all types of random-wound coils (including solenoids), and series-wound armatures. Poly-Thermaleze is stated to be the best wire available for epoxy encapsulations, to have possibilities for use in hermetic units, and to be compatible with any of the conventional class A, B, or F varnishes in class A, B, or F insulation systems. For higher than class F systems, it reportedly should be considered for use with the silicone-based varnishes. Other outstanding properties claimed include no solvent shock, high abrasion resistance, no heat shock, superior windability, excellent cut-thru resistance, and high dielectric strength. Competitively priced, it is available in a complete range of grades and sizes of rounds, squares, and rectangular wire. Comparative test results report available. Phelps Dodge Copper Products Corp., Inca Manufacturing Div., Fort Wayne, Ind.

Print No. Ins. 102 on Reader Service Card

Synthetic Rubber Resists Ozone, Weather, Abrasion, and Chemicals

New "Hypalon" synthetic rubber, an improved version of an older insulating material used on service drops and secondaries, spark plug boots, gaskets, and other electrical insulating applications, is said to have several advantages including ability to be color-coded without reducing its outstanding weather, sunlight, and ozone resistance, and easier compounding. Other properties of the chlorosulfonated polyethylene compound cited are good dielectric strength and flame resistance, excellent chemical and abrasion resistance, and temperature range of —80 to 350°F (—62 2 to 177°C). It is rated for 90°C service by Underwriters' Laboratories. A thermosetting material, it can be molded, extruded, calendered into thin sheets, or put into solution for use in protective coatings. E. I. du Pont de Nemours and Co. Inc., Elastomer Chemicals Dept., Wilmington 98, Del.

Print No. Ins. 103 on Reader Service Card

Ceramic Printed Circuits for 1800°F.

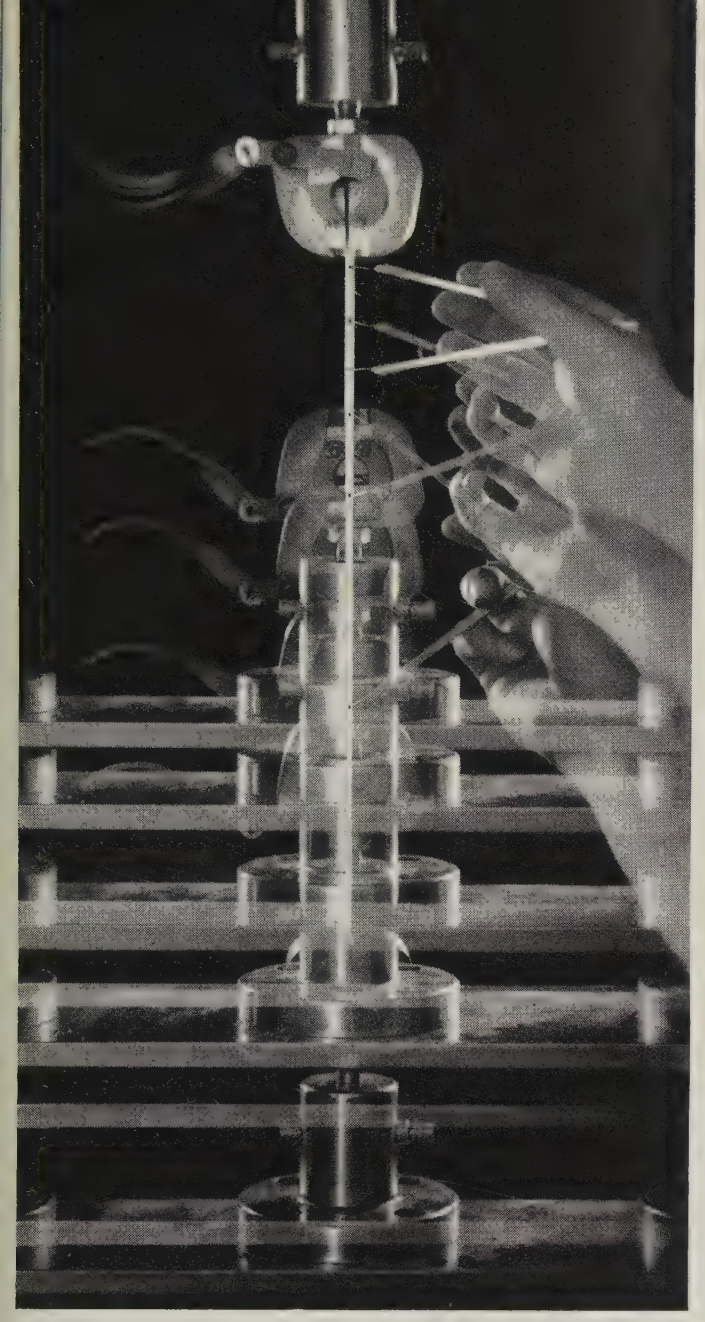
New ceramic printed circuits mass

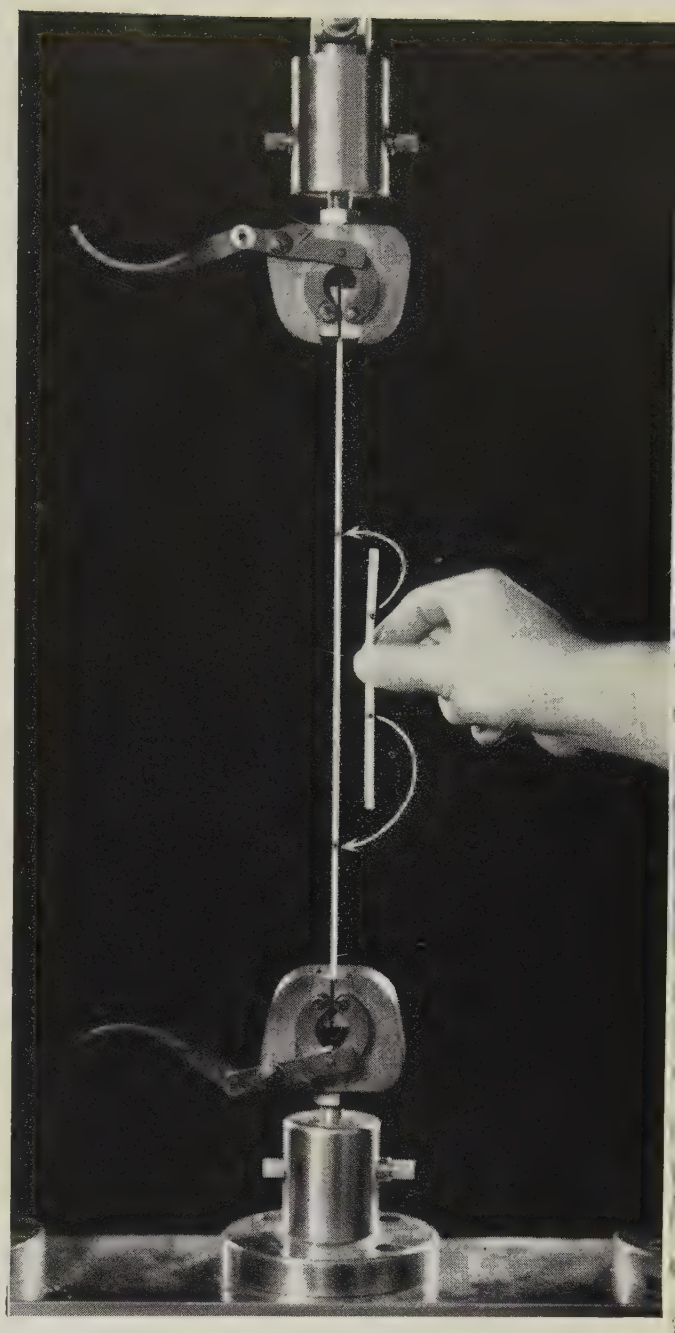
produced in sizes up to 18 sq in reportedly will withstand 1800°F (982°C) and equally exacting humidity and corrosive environments. Another advantage cited is that components used on these boards can be hermetically sealed to either or both faces. The printed circuits are composed of high alumina bases (96%) and circuits (screened on) of molybdenum and manganese. The circuit is protected with an electroplated coating of nickel or copper which serves as a base for solder assembly techniques. Through-plated holes can be provided. Close tolerances are stated to be held. Mitronics Inc., 1290 Central Ave., Hillside, N.J.

Print No. Ins. 104 on Reader Service Card

Copper-Clad Epoxy-Paper Laminate For Printed Circuit Applications

A new "Textolite" copper-clad laminate reportedly has improved characteristics for printed circuit applications. Designated number 11577, the new self-extinguishing, epoxy, paper-base laminate is stated to surpass any XXXP grade. Excellent cold punching and machining properties, high insulation resistance, and superior electrical characteristics are claimed. The new laminate has 1,000,000 megohms resistance at 35°C and twice the impact and flexural strengths of XXXP standards. Textolite 11577 is designed to withstand cyanide plating solutions and to provide improved bonding strength between copper and laminate for increased circuit reliability. Peel strength after Underwriters' Laboratories aging test (1544 hours at 128°C) has proved to be between 4 and 6 lbs, significantly higher than the 1 lb peel strength called for in U/L specifications. General Electric





These photographs show Opalon 1040 insulation, after aging 7 days @ 121°C., being stretched over 2½ times—a retention of 92% elongation of unaged material!

After aging 7 days at 121°C., OPALON® 1040 vinyl insulation retains 92% elongation!

Opalon 1040—UL-approved compound for THW* insulation and jacketing—provides a wide margin of safety in passing UL specifications. These photographs graphically show how. In elongation and retention of elongation after aging—*the major areas where failure may occur*—new 1040 is outstanding.

With a fine balance of electrical and physical properties, and processing characteristics, Opalon 1040 is highly useful for insulation and jacketing for building wire, and jacketing for communication and distribution wire. Its excellent moisture-resistance produces jacketing and insulation that protects against conductor corrosion and oxidation under extreme moisture conditions.

Write for complete technical and processing data on Opalon 1040, to Monsanto Chemical Company, Plastics Division, Room 760, Springfield 2, Mass.

*Under the THW classification, up to 20% more current can be run through conductors than could be with TW conductors. Smaller conductors can be used, saving conduit space, cutting wiring costs. Maximum operating temperatures raised from 60° to 75°C.

Monsanto®

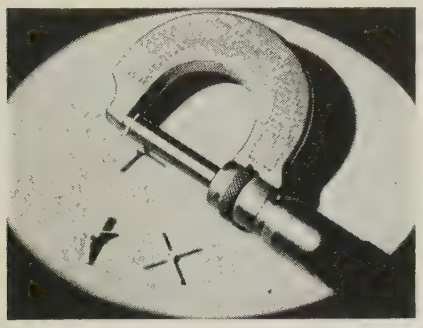
MONSANTO ACTIVATOR IN PLASTICS

Co., Laminated Products Dept., Schenectady 5, N.Y.

Print No. Ins. 105 on Reader Service Card

Precise Tiny Ceramic Parts In Complex Shapes

Subminiature, complex ceramic shapes manufactured with greater precision than previously possible are said to open new design possibilities for electronic engineers. In example pictured, webs reportedly are held to ±.001″ and comparable tolerances are said to be held on concentricity.



This precision is stated to be of special significance where coefficients of expansion must be matched or where other physical characteristics are of dominant importance in the application. American Lava Corp., Chattanooga 5, Tenn.

Print No. Ins. 106 on Reader Service Card

New Pressure-Sensitive "Teflon" Tape Can Be Encapsulated

"Temp-R-Tape" TSP is a new pressure-sensitive Teflon tape for extreme high-temperature design. The skived Teflon film backing has a special primed surface which is said to provide two distinct advantages: 1) It will accept encapsulating resins and electrical varnishes, and 2) it can be marked with almost any commercially available ink. The non-corrosive tape is .006″ thick and has a silicone polymer adhesive. It is recommended for electrical applications where high dielectric strength, low power factor, and negligible moisture absorption are important. It is also said to meet class H insulation requirements and to provide a tight wrap over sharp bends and irregular surfaces because of its elongation and plastic memory. The Connecticut Hard Rubber Co., 407 East St., New Haven 9, Conn.

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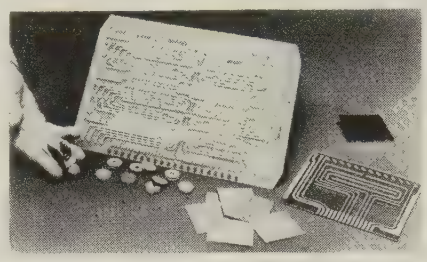
Combination Insulating Materials

Many combination materials for applications requiring the versatility of "Phenolite" laminated plastic or vulcanized fibre bonded to other materials can be furnished to meet special requirements. The following ex-



amples of combination materials show some of the present uses. Rubber-Phenolite for resilience, shock absorption, or the metal sealing characteristics of rubber. Rubber-fibre for some types of condenser sealing washers or for shock absorbing applications where the toughness of vulcanized fibre is desirable. Phenolite-fibre for arc resistance of fibre and the dimensional stability and mechanical strength of plastic. Metal-Phenolite in sheet form for printed circuits; and in tubing the metal can serve as a ground or electrostatic shielding. Metal-fibre for spark plate capacitors, shims, or gaskets. Asbestos paper-fibre for flame resistant arc barriers and deflectors in high voltage arc interrupting devices. Vulcanized fibre-"Mylar" provides a dielectric strength superior to that of straight vulcanized fibre and offers superior arc resistance with excellent non-tracking qualities. It is used in arc chutes, motor slot liners, and insulating barriers. National Vulcanized Fibre Co., 1060 Beech St., Wilmington 99, Del.

Print No. Ins. 108 on Reader Service Card

New 4″ High Flame Resistant Plastic Wireway with High Capacity

A new, 4″ high, control panel wireway in 1″, 1½″, 2″, and 3″ widths is said to meet JIC requirements and the needs of industry for a modular panel wireway that has increased wire holding capacity. A feature of this new wireway is its adaptability to job conditions achieved because of the independent top, bottom, and sides. The panel wireways are made from a tough, durable, plastic material that is flame resistant. The material reportedly has excellent insulating qualities and is dimensionally stable. Covers snap on and are tightly held to each side by means of two "ball and socket" grips. E C P Corp., 4726 Superior Ave., Cleveland 3, Ohio.

Print No. Ins. 109 on Reader Service Card

Alumina-Polyester Molding Compound With High Track and Flame Resistance

A new fiber glass reinforced alumina-polyester molding compound with high track and flame resistance, "Resistrac" grade 1403 compound, is said to combine the toughness and moldability of high impact plastics with carbon tracking resistance adequate for most indoor applications currently being served by ceramics. Under the suggested ASTM tracking resistance test. Resistrac is claimed to exhibit no carbon formation after 400 hrs. Sample shown (right in photo) is eroded after 648 hrs but

exhibits no carbon formation. Phenolic sample (left in photo) failed by tracking to ground in 27 min. Shatter-proof performance under the thermal shock of power flashover and 3 to 6 ft lbs Izod impact strength as compared with 0.5 to 1.0 ft lbs for most ceramics are other features reported. Costs are said to be competitive with all but the least expensive general purpose molding compounds. Data and samples available on letterhead request only direct to The Glastic Corp., Molding Materials Div., 4321 Glenridge Rd., Cleveland 21, Ohio.

Fusible Silicone Tape and Tubing

A new silicone rubber triangular tape and tubing have been developed for use in electrical manufacturing. "SIL-RAP" Guideline tape is a flexible, fusible silicone tape with a colored guideline for wrapping requiring only contact pressure to bond to itself. It is serviceable at —130°F

How to Use Vulcanized Fibre for Electrical Insulation

by Earl A. Russell, Chief Engineer, Spaulding Fibre Company, Inc.

While all standard grades of Vulcanized Fibre can be used for many electrical insulating applications, the more exacting uses call for Spaulding's Electrical Insulation Grade — Armite.

Spaulding Armite is produced in thicknesses of 1/32 inch and under with a consistently higher dielectric strength than is available in other grades of fibre.

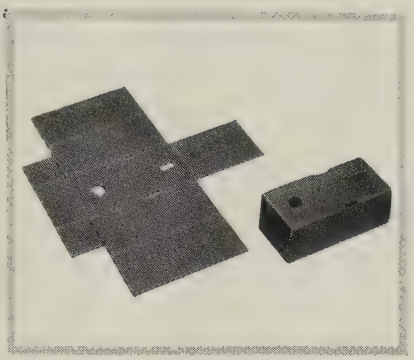
Special technical control of the manufacture of Armite makes it possible to combine this higher electrical quality with exceptional durability and forming qualities. Thus, Armite is particularly well suited for a wide range of both electrical and mechanical applications.

These uses include formed armature bonnets to insulate the windings from lead wires to the commutator, as well as for slot cell insulation in small armatures. Industry has also found extensive use for Armite in small, fractional horsepower motors. Here it is used in formed top sticks or wedges to insulate and anchor wires securely in the slots.

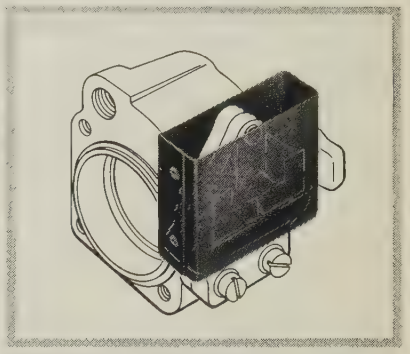
In "Barrier Insulation," the term used by Underwriters Laboratories for electrical insulation between live metal parts and adjacent live or ground metal parts, Armite finds one of its broadest applications. In this use, Armite insulators line the metal housing of electrical devices where space by itself is insufficient to provide gap insulation.

These Armite liners or "barriers" can be designed to accommodate almost any straight line contour. In .015″ or .020″ gauge Armite, fold lines are established economically by creasing in a punch press operation.

In thicker Armite, such as the more commonly used 1/32″, score lines are punched in a fast punch press operation. This permits folding to fit neatly inside the housing box. Whether creased or scored, Spaulding ships these parts flat and ready to be formed easily by hand for insertion.



For barrier insulation as switch box liner, Armite is creased in punching operation for rapid hand forming.



For barrier insulation as removable terminal cover scored and formed, Armite is held in shape with eyelets and in place with indent at base.

In these, as in a vast range of other applications, Spaulding Armite makes it possible to design and execute finished assemblies of assured electrical qualities without sacrificing economy.

Armite's superior dielectric properties, coupled with good forming and structural stiffness, have made it the traditional choice of designers throughout the electrical industry.

to 500°F (—90°C to 260°C). The triangular cross section insures a uniform thickness of the wrap. Applications include its use as an electrical insulating tape wrap for cables, coils, bus bars, splices, complex cable harnesses, and electrical and electronic units where potting is difficult or impractical. "SIL-BLU" silicone tubing is fabricated from a silicone compound that reportedly provides the most useful combination of physical strength, elongation, and resistance to compression set. It is expected to be useful as a slip-on insulation. Minnesota Rubber Co., 3630 Wooddale Ave., Minneapolis 16, Minn.

Print No. Ins. 110 on Reader Service Card

Lower Cost, Heat Resistant Flexible Tubing and Monofilament

A new line of flexible spaghetti tubing and monofiliament, "Penntube" III, is extruded from a new, tough, clear, modified trifluorochloroethylene polymer reported to have the thermal and chemical stability of fluorocarbons and the advantages of lower cost, transparency, and heat sealability. Available in monofilament down to .008" and tubing in AMS 3648 sizes, wide application in difficult electrical and electronic design problems where ordinary materials won't do, and in other areas are expected. Typical applications include instrument tubing, electrical sleeving, and cable sheathing. Penntube III is said to be highly impermeable and to have extreme resistance to all inorganic corrosive liquids, including oxidizing acids, and resistance to most organic solvents. This non-flammable material is stated to have outstanding electrical properties with high volume and surface resistivity at high and low temperatures, zero moisture absorption, low dielectric constant, and good power factor at high temperature and high frequency. Pennsylvania Fluorocarbon Co. Inc., 1115 N. 38th St., Philadelphia 4, Pa.

Print No. Ins. 111 on Reader Service Card

Glass-Silicone Tubing for 500°F

A new rolled glass-silicone insulating tubing is designed for use in electrical and electronic applications demanding good electrical properties at temperatures up to 500°F (260°C). Designated grade 11556, the new rigid, white opaque silicone tubing is claimed to have extremely low dielectric loss and superior arc and tracking resistance at these elevated temperatures. It has a dissipation factor of .0015 and arc resistance of 240 seconds. These electrical characteristics, combined with good machinability, very high tensile strength, and impact resistance are said to make this new grade suitable for a wide variety of applications, such as coil forms, lead insulation fabricated parts for electronic equipment, and tubular insulating parts. General Electric Co., Laminated Products Dept., Coshocton, Ohio.

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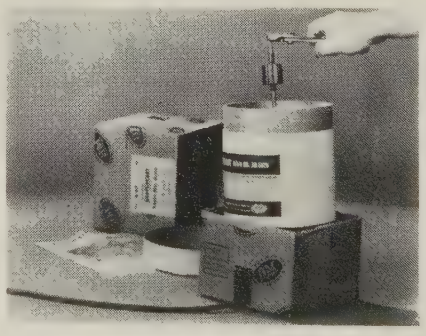
New Epoxy Resin Powder And Aerator Bed Test Kit

"Scotchcast" brand resin XR-5026, a new one-part epoxy resin powder for use in insulating electrical and



electronic components with a permanent, tough finish, is stated to give superior edge coverage and in most cases to require no post-cure. It is available in a test kit which also serves as a powder aerator for experimental applications. Principal use of the resin is in coating and moisture-proofing stators and rotors, resistors, capacitors, toroids, printed circuits, bus bars, electronic components, and any intricately shaped objects. The resin can be applied by various methods of suspension coating, such as aerated bed or spray coating. A smooth, uniform coating reportedly may be obtained by using a dip cycle of one to three seconds. The epoxy powder adheres to the hot object, melts, flows slightly, then cures. The retained heat in units having a high heat capacity is said to be sufficient to completely cure the resin, eliminating the need for oven curing. Exceptional "cut-through" resistance in stator applications and high impact strength are claimed. Electrical properties include an electric strength of 500 to 800 vpm; a dielectric constant of 3.61 at 23°C and 60 cycles; and a dissipation factor of 0.0053 at 23°C and 60 cycles. The test kit consists of a powder aerator and a 4-lb package of the resin designed in such a manner that the shipping carton becomes a part of the aerator. After opening the carton, the user merely connects an air hose to the universal inlet tip on the aerator, pours in the desired amount of resin, and the aerator is ready for use. Dept. WO-199, Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn.

Print No. Ins. 113 on Reader Service Card

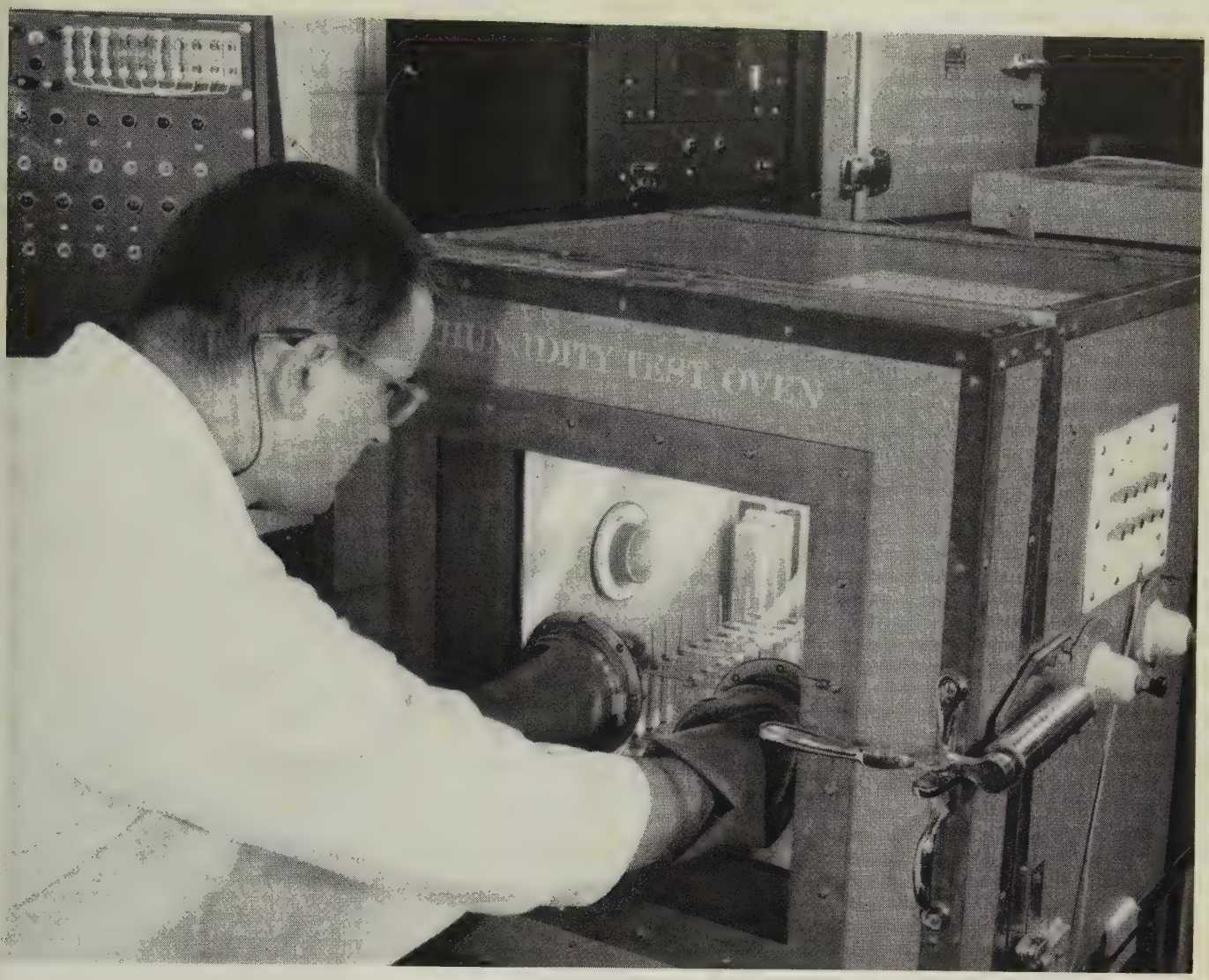
Asbestos-Phenolic Molding Compound

RX-495, an asbestos reinforced phenolic molding compound, has been approved for applications under Government specification MIL-M-14F, Type MFI-20. Excellent molding properties reportedly allow it to be used on transfer and compression molds involving intricate details. Characteristics reported include heat distortion temperature of over 500°F (260°C), molding shrinkage of less than 0.001 in /in, impact strength of 2.5 ft lbs (notched bar), and flexural strength of 12,000 psi. It is said to be especially suited for uses in controls and electrical switchgear where excellent dimensional stability, high physical strength, heat resistance, and good electrical properties are required. Rogers Corp., Rogers, Conn.

Print No. Ins. 114 on Reader Service Card

Self-Extinguishing, Flexible Epoxy Casting Compound for Electrical Uses

A new, flexible epoxy casting compound, "Hysol" 15-032, is a two-component, filled epoxy casting system



Insulation of "Mylar" gives capacitors longer-lasting stability under high humidities

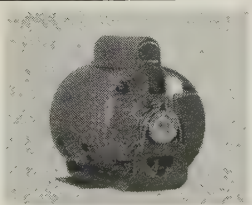
Punishing, hot, humid atmospheres like those in the test chamber above have little effect on capacitors insulated with "Mylar"* polyester film. These capacitors have remarkable stability and longer life, because "Mylar" is much less sensitive to high temperatures, changing humidity and aging than other commonly used insulating materials.

Capacitors made with "Mylar" meet the highest standards of reliability, yet are frequently smaller and less costly than other units. Thinner insulation can be used, because of the exceptionally high dielectric strength of "Mylar". And "Mylar" reduces the need for costly encapsulation because of its remarkable resistance to moisture.

Whether you manufacture or buy electrical products, you can get improved performance with "Mylar". And, figured on a square-foot basis, "Mylar" will often cost you less than your present material. For full facts on "Mylar", write for free booklet. E. I. du Pont de Nemours & Co. (Inc.), Film Department, Rm. No. 14, Wilmington 98, Del.

Tough, thin "Mylar" has this unique combination of properties for superior insulating performance:

- Average 4,000 volts per mil dielectric strength (Per ASTM D-149). Average power factor of 0.002 at 60 cycles.
- Thermal stability from -60°C to Class B range.
- Chemical and moisture resistance.
- Resistance to aging, abrasion, tearing and rotting.



IN MOTORS — Insulation of "Mylar" cuts size and weight, improves moisture resistance . . . at no increase in cost.

*"*Mylar" is Du Pont's trademark for its brand of polyester film.*

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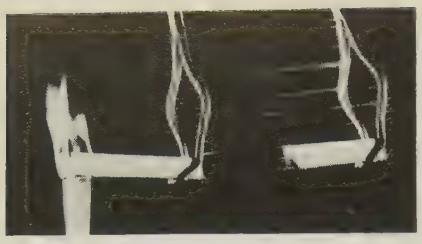
Better Things for Better Living . . . through Chemistry

DU PONT MYLAR® POLYESTER FILM

Print Ins. 32 on Reader Service Card



recommended for use on transformers and other electronic and electrical parts. Non-burning under ASTM D635-56T and self-extinguishing according to MIL-I-16923C and MIL-T-27A tests, Hysol 15-032 is also flexible and can be used as embedding material when required to meet thermal shock conditions. Available in white and pastel colors. Hysol Corp., Olean, N.Y.

Print No. Ins. 115 on Reader Service Card

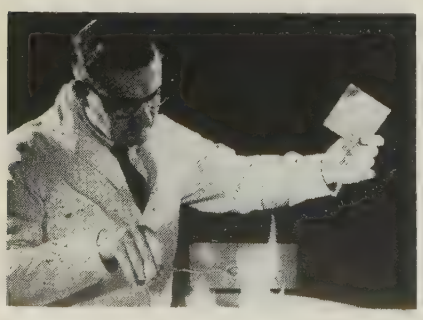
Polyurethane Foam for Insulating

"Stafoam" urethane is said to be useful for insulating, cushioning, and potting transformers, terminals, junction boxes, and electronic devices because of its ability to penetrate into tiny spaces. Dielectric constants and power factors also reportedly are suitable for electrical applications. The material sets at room temperature, sound proofs, and adds to structural strength. American Latex Products Corp., Division of Dayco Corp., 3341 W. El Segundo Blvd., Hawthorne, Cal.

Print No. Ins. 116 on Reader Service Card

Flame-Retardant Epoxy-Glass Laminate For Printed Circuit Is Not Brittle

A new flame-retardant, 155°C, epoxy-glass laminate for printed circuits reportedly has excellent electrical properties, moisture resistance, high strength, and good machinability. Identified as No. 6097 "Lamicoid," the maroon laminate is available unclad or clad with 1 or 2-oz copper foil bonded to one or both sides. In a standard flame retardancy test (ASTM D635-56T) ⅛" specimens of the new laminate are said to have extinguished themselves just 2 sec after the flame was removed. Other outstanding features reported include non-brittleness (readily fabricated by conventional techniques), high copper foil-to-laminate peel strength, not affected by standard plating and etching solutions, ability to withstand dip or float soldering, and ability to meet the requirements of MIL-P-18177B type GEB. Mica Insulator Div., Minnesota Mining and Manufacturing Co., Schenectady 1, N.Y.



Print No. Ins. 117 on Reader Service Card

Improved Epoxy Resin Cures Faster, Is More Resilient and Stronger

Improvements in "Maraglas" crystal-clear epoxy resin No. 655 are said to include easier and faster cure, greater resiliency, and higher impact strength. Temperatures as high as 180°F (82°C) for curing relatively small objects and cures to a Rockwell hardness between M 50 and M 100 are claimed possible. Embedment of large objects is said to be facilitated by the resiliency now offered. High-impact end products made from the resin reportedly have good weather resistance and do not craze or become brittle. Among successful "Maraglas" uses are electronic encapsulations and bonding glass to glass. Marblette Corp., 37-31 Thirtieth St., Long Island City 1. N.Y.

Print No. Ins. 118 on Reader Service Card

Semi-Cured Permafil Glass Cloth For Machine-Taping of Coils

A new semi-cured, permafil-treated glass cloth reportedly can be easily applied to coils and cured without pressure. The new development is expected to make machine-taping of coils with a semi-cured tape economically feasible. Chief advantages cited are that the tape doesn't require an interliner and that it can eliminate the conventional varnish "dip and bake" process necessary for untreated tapes. The new tape should shorten the manufacturing cycle because it can be machine wrapped and requires only one baking of from 30 min to 1 hr, using normal oven temperatures. Rated for class B operation, it is available in thicknesses of from .005" to .011". Al-

though designed primarily for use on motor armature or field coils, the tape also can be used to tie down field coils and band armatures and the exposed end of commutator cones. In addition, the tape can be used in the manufacture of laminates and molded forms such as coil spools, terminal boards, and relay covers. General Electric Co., Insulating Materials Dept., Schenectady 5, N.Y.

Print No. Ins. 119 on Reader Service Card

Post Insulators with Wide Spacing For Reduced Corona, Improved Cleaning

A new line of station post insulators 7.5 through 69 kv (EEI-NEMA standard units) are designed with scientifically proportioned wide spacings between insulator hoods. This spacing reportedly retards water bridging (see

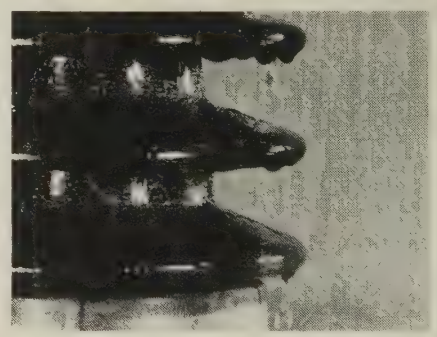
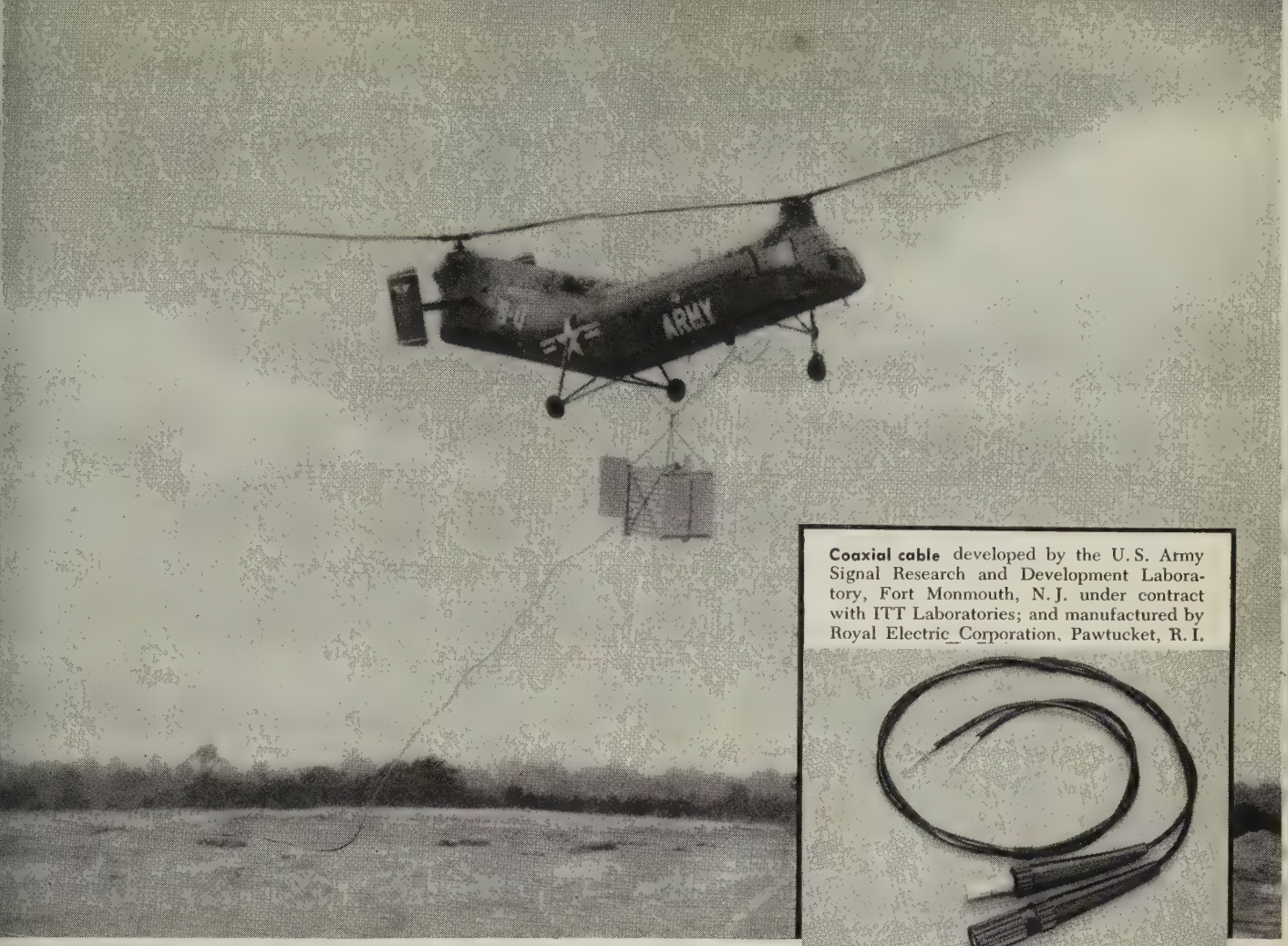


photo) by breaking up the drip stream, reduces corona, permits natural cleaning, simplifies hot line washing, and improves effectiveness of leakage distance. Insulator Dept., General Electric Co., P.O. Box 57, Baltimore 3, Md.

Print No. Ins. 120 on Reader Service Card

Infusible Urethane Foams For High Temperature Insulation

New rigid urethane foams reportedly retain from 45% to 65% of their room temperature compressive strength at 600°F (316°C) and cannot be melted or fused at any temperature (flexible foam systems for high heat have also been developed). At increasingly higher temperatures a cellular structure is maintained until the foams begin to carbonize at about 900 to 1000°F, after which they pass directly to a gaseous state. High dielec-



Coaxial cable developed by the U. S. Army Signal Research and Development Laboratory, Fort Monmouth, N. J. under contract with ITT Laboratories; and manufactured by Royal Electric Corporation, Pawtucket, R. I.

Jacketed with High-Density Polyethylene— Military Cable Laid at 100 MPH!

Modern warfare requires highly dependable, quickly installed communications systems. To meet this demand, the U. S. Army Signal Research and Development Laboratory, Fort Monmouth, New Jersey has developed a new coaxial cable nomenclatured CX-4245/G, which, during engineering tests, has been laid by helicopter at speeds up to 100 mph! The new cable consists of a twisted pair of small coaxials, each jacketed with BAKELITE high-density polyethylene DGD-4100 to provide the exceptional toughness and protective qualities essential during cable laying and in actual use.

Ten miles of this cable will be boxed and carried in an aluminum frame and laid by helicopter in about six minutes. It can be strung with extreme accuracy, and even suspended in trees to cross rivers and roads.

This aerial installation calls for the superior abrasion resistance, shear strength, environmental and thermal stress cracking resistance found in BAKELITE high-density polyethylene DGD-4100. Along with these improved properties are the familiar polyethylene advantages of light weight, excellent insulating properties and ease of handling.

Get more information and samples of this material by writing Dept. BG-75, Union Carbide Plastics Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. *In Canada:* Union Carbide Canada Limited, Toronto 7.

TYPICAL PROPERTIES "BAKELITE" DGD-4100 BLACK 9845

Properties	ASTM Test	Typical Value
Melt Index @ 44 psi (gms/10 min)	D 1238	0.2
Density	D 1505	0.957
Tensile Strength, psi	D 412	3400
Per Cent Elongation	D 412	250
Durometer Hardness, Shore Type "D"	D 676	58
Brittleness Temp., °C.	D 746	-95
Shear Strength, psi	D 732	3000
Stiffness in Torsion, @ 23°C., psi	D 1043	100,000
Tree Wire Abrasion Test	(1)	
50% Abraded (Cycles)		800,000 ca.
100% Abraded (Cycles)		1,500,000 ca.
Environmental Stress Cracking, F_{50}, hrs.	D 1693 (2)	500
Thermal Embrittlement Resistance, hrs. @ 70° C., F_0	(3)	5000
Deformation at 110 deg. C., per cent	(4)	0
Dielectric Constant	D 1531	2.65
Dissipation Factor	D 1531	.004
Dielectric Strength, Short Time, volts/mil	D 149	580

(1) IPCEA Tree Wire Test — S1981
(2) Samples previously aged 7 days @ 70° C.
(3) Standard U/L Heat Shock Test — 1/32" insulation on #14 AWG solid copper conductor wrapped around its own diameter.
(4) UCPC Method WC 75 B/3—1/32" wall on #14 AWG wire. Test terminated at 5000 hrs.

UNION CARBIDE

"Bakelite" and "Union Carbide" are registered trade marks of Union Carbide Corporation.

Print Ins. 33 on Reader Service Card

tric strength is also said to be retained over a wide temperature range. Dimensional integrity is said to be maintained to 450°F. The molecular weight is about 390; volatility, therefore, is low and toxicity problems of foam production are reduced. Carthane 1008 infusible foam system is fast reacting and produces rigid foams that have mechanical strength in frigid to intensely hot environments. Identical properties are found in a second product, Carthane 1003, which, in addition, has a controllable pot life of 5 to 12 min, enough to allow the material to flow into voids of complicated shapes before reaction begins. Density (unrestricted rise) ranges from 3 to 40 lb/cu ft. The Carwin Co., North Haven, Conn.

Print No. Ins. 121 on Reader Service Card

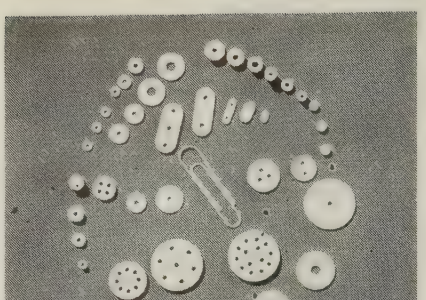
Nylon Tape for Wire Tying Fastens to Itself 100,000 Times

A unique nylon tape fastening device for harnessing electrical wire can be opened and closed at least 100,000 times without loss of holding power, it is claimed, making it ideal for use on a temporary tie where repeated accessibility or replaceability is required. Called Back-to-Back "Velcro," it consists of a single strip of nylon tape faced on one side with tiny hooks and on the other, with soft loops. When the two sides are pressed together, they lock to form a secure, long lasting closure. Shear strength is 6-8 lbs/sq in. The tape is made entirely of nylon and reportedly has excellent insulating properties, has passed static electricity resistance tests, and fulfills the requirements for flammability. Information and samples available. Velcro Corp., 681 Fifth Ave., New York 22, N.Y.

Print No. Ins. 122 on Reader Service Card

Glass Beads in Many Shapes for Hermetic Sealing Components

A complete line of multiform glass beads in a variety of shapes for hermetic seal header applications such as transistor bases or relay covers is now available for both Kovar and compression type hermetic seals. The parts are available in all the RMA colors in a range of sizes from single hole beads to multi-hole ones. Many different hole arrangements may be



produced. Electronic-Ceramics Co., 188 Belmont Ave., Belleville, N. J.

Print No. Ins. 123 on Reader Service Card

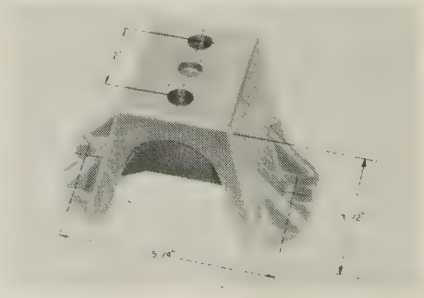
Solvent-Resistant Polymer for Coatings, Wire Enamels, Resins

A new, extremely solvent-resistant polymer with a high softening point, called resin D-430-B, contains hydroxyl groups which reportedly produce strong bonds with metal surfaces. It is suggested as an intermediate in the preparation of other useful resins and chemical compounds. Some of the suggested applications are in wire enamels, surface coatings, and as a polyol or intermediate. The new resin is stated to be soluble in only a few selected solvents at room temperature and to be insoluble in all common solvents such as alcohols, esters, ketones, hydrocarbons, and chlorinated solvents. It has shown solution and film compatibility with a variety of resin types including blocked polyisocyanates, phenolic resins, polyvinyl acetals, epoxy resins, and melamine resins. Dept. WM, Shawinigan Resins Corp., Springfield, Mass.

Print No. Ins. 124 on Reader Service Card

A-Frame Insulator for High Current Bus or Rail Support

A new high-strength, A-frame type insulator is stated to be particularly applicable for high current bus or rail support in heavy-duty industrial use as well as in apparatus requiring an exceptionally rugged insulator. Features include a large top mounting



area and a wide base for high cantilever strength. The base is designed for fastening with ½" bolts and nuts as compared to threaded insert mounting with conventional insulators. The insulator reportedly has chipping and flashover resistance, high strength, and other properties characteristic of the fiber glass reinforced polyester of which it is molded. The Glastic Corp., 4321 Glenridge Rd., Cleveland 21.

Print No. Ins. 125 on Reader Service Card

Chemical Intermediate for Solvents, Plasticizers, Urethane Resins

New isosorbide ($C_6H_{10}O_4$) is suggested for use as a chemical intermediate in the preparation of esters and ethers for specialty solvents and plasticizers. Isosorbide is a white crystalline solid with a high flash point and humectant properties similar to sorbitol. It is soluble in water, alcohol, glycerol, and other polar solvents. Polyethers and polyesters of isosorbide may provide urethane resins with unique properties. Isosorbide is available in development quantities. It is offered as an anhydrous product and as an aqueous solution (85% solids), both in stabilized and unstabilized forms. Revised Product Bulletin No. D1-5 available. Chemicals Div., Product Development Dept., Atlas Powder Co., Wilmington 99, Del.

Print No. Ins. 126 on Reader Service Card

Rubber in Paste Form for Insulating, Sealing, and Adhesive Uses

Devcon Rubber in paste form is now reportedly used in many indus-

tries for insulating electrical equipment, sealing or caulking around machinery, making gaskets, and as a coating to protect machinery, piping, etc., against rusting or corrosive liquids. The general purpose repair material is stated to have tremendous strength, and to be an excellent ad-

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of our Fiberglas* electrical tapes
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Distributors

ATLANTA, GEORGIA
ELECTRICAL INSULATION SUPPLIERS
500 Means Street, N.W.

BOSTON, MASSACHUSETTS
HUSE-LIBERTY MICA CO.
Peabody Industrial Center
Peabody, Massachusetts

CHICAGO, ILLINOIS
INSULATION MANUFACTURERS CORP.
565 W. Washington Blvd.

CLEVELAND, OHIO
INSULATION MANUFACTURERS CORP.
1231 Superior Avenue, N.E.

COLUMBUS, OHIO
NATIONAL ELECTRIC COIL
Division of McGraw-Edison Co.

DALLAS, TEXAS
SUMMERS ELECTRIC COMPANY
1302 So. Good-Latimer Expressway

DAYTON, OHIO
INSULATION MANUFACTURERS CORP.
120 West Second Street

DETROIT, MICHIGAN
INSULATION MANUFACTURERS CORP.
7430 Second Blvd.

LOS ANGELES, CALIFORNIA
H. I. THOMPSON FIBER GLASS CO.
Blackwood's Division
3609 East Olympic Blvd.
WESTERN FIBROUS GLASS PRODUCTS CO.
4423 Fruitland Avenue

MILWAUKEE, WISCONSIN
INSULATION MANUFACTURERS CORP.
2040 West Wisconsin Avenue

NEWARK, NEW JERSEY
ROBERT McKEOWN COMPANY INC.
99 Dorsa Avenue, Livingston

NEW YORK, NEW YORK
MITCHELL RAND MFG. CORP.
Insulation Division, 51 Murray St.

PHILADELPHIA, PA.
EARL B. BEACH COMPANY
500 East Broadway, Clifton Heights, Pa.

PITTSBURGH, PA.
EARL B. BEACH CO.
Verona & Mt. Carmel Rds.

PITTSBURGH, PA.
INSULATION MANUFACTURERS CORP.
535 Smithfield Street

SAN FRANCISCO, CALIFORNIA
WESTERN FIBROUS GLASS PRODUCTS CO.
739 Bryant Avenue

SEATTLE, WASHINGTON
WESTERN FIBROUS GLASS PRODUCTS CO.
1915 First Avenue S.

ST. LOUIS, MISSOURI
WHITE SUPPLY COMPANY
4343 Duncan Avenue

Horace Linton Division
HESS, GOLDSMITH & CO., INC.
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Makers of Quality Fiberglas Tapes... including HESGON

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hesive for rubber, ceramic, wood, many plastics, and other materials. It is also said to be tough, permanently flexible, easy to use, waterproof, fast setting, and unaffected by oil, gasoline, and most chemicals. A pint container comes with a special brush and a plastic applicator or caulking nozzle. Free bulletin available. Devcon Corp., Danvers, Mass.

Print No. Ins. 127 on Reader Service Card

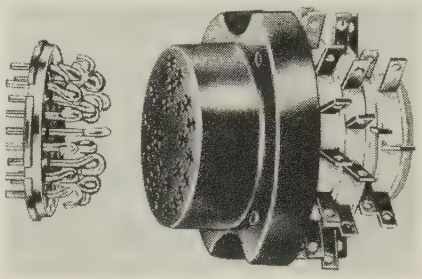
Cleaners and Stripping Agents For Epoxy and Polyester Resins

New "Meta-Terge" 1405 is stated to be a safety cleanup detergent for uncured epoxy and polyester resins, while "Meta-Strip" 702 is said to be a powerful, synergistic, non-corrosive solvent for removing and stripping cured epoxy resins from embedded electronic assemblies and wire. Meta-Terge 1405 is claimed to be more economical than straight solvents since its use allows the insoluble resins to be cleaned with water. Mereco Products Div., Metachem Resins Corp., 530 Wellington Ave., Cranston 10, R.I.

Print No. Ins. 128 on Reader Service Card

Test Sockets for Hermetically Sealed Components

The Barnes test socket is now available in 150 standard configurations to accept a wide variety of relays, chokes, transformers, packaged circuits and other components. These sockets accept headers with hook, pin, turret, and other types of terminals. All sockets have two mutually insulated contacts to each terminal for

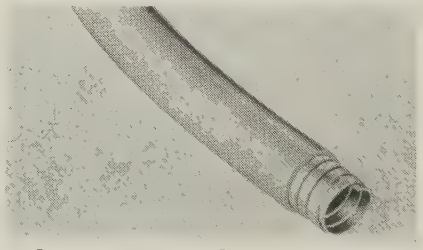


use in contact resistance measurement, or for added testing reliability. Sockets are constructed of mica-filled epoxy or urethane rubber and are suitable for environmental testing. Barnes Development Co., 213 W. Baltimore Ave., Lansdowne, Pa.

Print No. Ins. 129 on Reader Service Card

Vinyl Covered Flexible Steel Conduit For Electrical Wiring in Wet Areas

A new liquid tight flexible steel conduit features a polyvinyl chloride synthetic resin cover and U.L. approval as a positive protection for wiring used in wet areas. Suggested applications include use on pumps, pressers, welders, grinders, blowers, conveyors, machine and portable tools



and on automatic lines for forging, plating, molding, blasting, rolling, die casting, processing, extruding, etc. In addition to keeping wiring safe and dry, the conduit, called Sealed Skin, is equipped with a copper wire positive ground and is said to be proved as complete protection against liquid and moisture vapor conditions. It also absorbs vibration and resists flame, oil, grease, dirt, chemicals, fumes, and salt spray. Free samples available. The International Metal Hose Co., Bellevue, Ohio.

Print No. Ins. 130 on Reader Service Card

Solvent for Epoxies and Polyesters Cleans, Salvages Electronic Units

New "Arisolv" solvent is said to exert strong solvent action on cured, as well as uncured, epoxy and polyester type resins. It can be used to reclaim and salvage electronic parts should a unit fail electrical testing and to clean equipment used in the mixing and handling of resins. Units that are to be reclaimed are merely soaked in this solvent. The resin disintegrates, leaving a salvaged unit. Arisolv is non-flammable and has a low order of toxicity. Aries Laboratories Inc., 225 Greenwich Ave., Stamford, Conn.

Print No. Ins. 131 on Reader Service Card

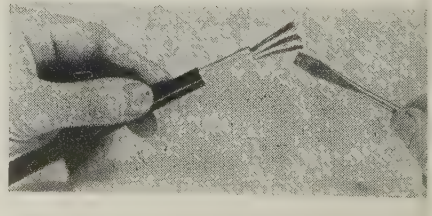
Wires and Cables Insulated and Jacketed with "Teflon" 100 FEP

Wires and cables insulated and jacketed with Teflon 100 FEP are said to offer a wide range potential for improved electrical designs, especially in high temperature fields. Hook-up wires, multiconductor cables, and miniature coaxial cables insulated with the material are stated to permit continuous service at temperatures to 175°-200°C and intermittent service at 250°C. Other advantages cited include no shrink or flare back when subjected to the soldering test per MIL-W-16878C, flexibility and mechanical toughness at —200°C or lower, high insulation resistance regardless of environmental conditions, and non-flammability. William Brand-Rex Div., American Enka Corp., Concord, Mass.

Print No. Ins. 132 on Reader Service Card

New "Multi-Lead" Extension Wire Reduces Thermocouple Wiring Costs

Multiple pairs of thermocouple extension wires harnessed into special cables, called Multi-Lead T/C extension wires, are stated to cut the cost of thermocouple wiring by reducing installation and maintenance time.



saving space, cutting material costs, and lowering final installed costs. Multi-Lead T/C extension wire is normally supplied with from 4 to 48 pairs of extension wire per cable. All pairs of thermocouple wire are numbered. In standard designs, the multiple insulated wire-pairs are cabled with aluminum-backed "Mylar" tape, and a choice of three different outside sheaths: 1) a PVC overall, 2) a steel armor overall, and 3) steel armor with a PVC overall. Pyrometer Co., of America Inc., Penndel, Pa.

Print No. Ins. 133 on Reader Service Card

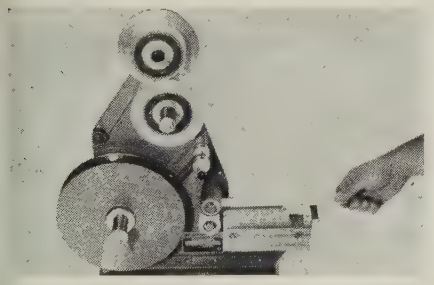
Polyethylene 300-Ohm Lead-In Cable

A new 300-ohm, flat, lead-in TV cable has a conductor of pure copper, #20 AWG, and a jacket of abrasion-resistant and waterproof polyethylene. Cable is packaged in coils of 25′, 50′, 75′, and 100′, with one end preassembled with lugs and other slit back for fast connection. Alpha Wire Corp., 200 Varick St., New York, N.Y.

Print No. Ins. 134 on Reader Service Card

Machine Laminates Double-Coated Tape To Insulation, Simplifies Assembly

Designed to make any electrical insulation pressure-sensitive right on the production line, the "Scotch" brand E-10 insulation laminator is designed



for use with the recently announced double-coated 1-mil polyester film tape, Scotch brand electrical tape No. X-1115. Insulating materials, such as mica, metal foil, and fish paper, formerly held by tying or jigs, may now be made pressure-sensitive for easy positioning during production runs and to eliminate expensive, time-consuming operations. The double-coated tape and the insulating material are laminated together as they are removed from dispensers. Minnesota Mining and Manufacturing Co., Dept. WO-202, 900 Bush Ave., St. Paul 6, Minn.

Print No. Ins. 135 on Reader Service Card

New Literature

All catalogs, bulletins, and other literature or sample cards described are available free of charge. To obtain your free copies, just print the item number on the Reader Service Card on the back cover. Fill out and mail the card—no postage is required. Insulation *immediately forwards your requests to the companies concerned so that literature can be sent to you promptly.*

Catalog of Compressed-Sheet Mica, Flexible Combinations, and Micapaper

Revised catalog No. 26 provides complete technical information on Macallen mica hard plates; flexibles and flexible combinations; tubing; micapaper plates, flexible combinations, and tapes; and custom fabricated parts. It also includes NEMA specifications for manufactured mica sheets and wrappers, and data on grading and classifying, types, properties, and processing of natural mica. 28 pages. Insulation Manufacturers Corp., 565 W. Washington Blvd., Chicago 6.

Print No. Ins. 201 on Reader Service Card

Engineering Data Book on Plastic Laminates and Printed Circuits

Catalog of laminated plastics gives basic engineering information on standard and modified grades of sheet materials, including data on base material and resin type, specific characteristics, NEMA grade, applicable government specifications, colors, thickness range, sheet sizes, weight per sq ft of ⅛″ thick material, and cost factor. General properties and thickness tolerances of laminated sheets are discussed. Other products covered include printed circuits, copper-clad laminates, and custom fabricated parts. Laboratory facilities, engineering services, quality control, and special handling of rush requirements are also discussed. 16 pages. Northern Plastics Corp., 2nd and Market St., LaCrosse, Wis.

Print No. Ins. 202 on Reader Service Card

Guide to Silicones for Electronics

New engineering guide explains how various physical forms of silicones contribute to reliability, miniaturization, modularization, and environmental protection; increase serviceability over wide extremes of temperature; and aid value engineering. Engineering data and processing information, important electrical and mechanical properties, and typical applications are given. 12 pages. Dow Corning Corp., Midland, Mich.

Print No. Ins. 203 on Reader Service Card

Manual and Chart for Selecting High-Pressure Laminated Plastics

A new guide for selecting high-pressure laminates consists of a manual and a separate wall chart of characteristics for 21 commonly-used laminate grades. The manual discusses high-pressure laminates, base materials, resins, minimum/maximum property values, and common mistakes made in ordering. Composite laminates are described. Step-by-step instructions on how to use the selection guide, an order check list, normal fabricating tolerances, a glossary of terms, and tables of standard NEMA thickness tolerances on laminated sheets, tubing, and rods are included. 12 pages. The chart of laminate characteristics assigns qualitative and quantitive values and gives principal characteristics, NEMA grade, applicable military specifications, and other pertinent engineering data. Taylor Fibre Co., Norristown, Pa.

Print No. Ins. 204 on Reader Service Card

New Booklet on Applications Of RTV Liquid Silicone Rubber

A new booklet, CDS-226, highlights the outstanding properties of RTV (room temperature vulcanizing) liquid silicone rubber and illustrates its uses in electronic and electrical assemblies as a sealing, coating, impregnating and bonding compound in a variety of applications, and its performance as a flexible mold material. A special section reviews applications in aircraft and missiles where long term reliability resistance to temperature extremes, aging, and various fluids is an important factor. 12 pages. General Electric Co., Silicone Products Dept., Waterford, N. Y.

Print No. Ins. 205 on Reader Service Card

Property Chart for Comparing Epoxy, Other Thermosetting Molding Materials

A new chart for compression and transfer molders shows the mechanical, electrical, and thermal properties of all general purpose thermosetting materials comparatively, including the relative position of epoxy molding compounds. Flexural strength, impact strength, heat distortion, dielectric strength, etc., of the materials under controlled tests are compared. Fiberite Corp., Winona, Minn.

Print No. Ins. 206 on Reader Service Card

Polymer Directory and Catalog

Revised polymer directory and catalog lists properties, end uses, and technical data for more than 150 chemical polymers. 12 pages. The Borden Chemical Co., Dept. H, 350 Madison Ave., New York 17.

Print No. Ins. 207 on Reader Service Card

Polycarbonate Application/ Property Data

The growing usage of polycarbonate resin in the electrical and electronics industries is described in new folder CDC-375. Coil forms, connectors, battery and barrier parts, terminals, housings, windows and covers, and current-carrying support parts are among the many applications illustrated and described. Electrical, physical, and thermal properties are listed, and chemical stability is discussed. 4 pages. Chemical Materials Dept., General Electric Co., One Plastics Ave., Pittsfield, Mass.

Print No. Ins. 208 on Reader Service Card

Data on Copper-Clad Laminates

Technical information on copper-clad laminates for printed circuits and other electrical uses is given in data sheet No. 8-1A. A table lists engineering data for eight grades of clad phenolic-paper, epoxy-paper, and epoxy-glass fabric laminates with corresponding NEMA grade base laminate designation and applicable mili-

NOMINAL WEIGHTS OF FINISHED WEATHER-RESISTANT WIRE AND CABLE

(Pounds per 1000 Feet)

Conductor Size AWG or Mcm	Copper & Copper Alloy Conductors: URC Type Double Braid	URC Type Triple Braid	Neoprene Type	Polyethylene Type	Aluminum Conductors: Neoprene Type	Polyethylene Type
Stranded						
2	246	270	248	230	105	87.4
4	155	170	163	143	73.3	53.3
6	103	115	108	91.5	51.5	35.0
Solid						
2	239	260	232	219	92.2	79.2
4	151	164	152	136	64.8	48.0
6	100	112	101	87	45.7	31.7

Sources: American Standards Association Specifications

This table shows

POLYETHYLENE covered line wire weighs less

Because it's the lightest, polyethylene-covered line wire is the easiest for linemen to string up . . . hardest for ice and snow loading, gale-force winds to bring down.

Polyethylene-covered line wire, depending on size and conductor, weighs from 5% to 32% less than other types. That's what the figures in the specifications tabulated above show.

This, of course, is no news to linemen who have strung all types of weatherproof line wire. They may not be able to quote pounds and percentages, but they all know you can't beat polyethylene on weight.

Linemen's Favorite Material

Light weight means easy handling, one of the main reasons polyethylene rates tops with installation crews. They also like polyethylene wire because it's clean...free-stripping... has a smooth, self-lubricating surface that almost makes pulling a pleasure. And despite the exterior slip, the plastic covering hugs the conductor tightly, doesn't ruffle as it goes over crossarms.

"Built-in" Safety Factor

Polyethylene's lightness provides lasting mechanical advantages, since span loads don't tax supports as much as heavier type wire. This "built-in" weight safety factor pays off when violent storms push aerial construction to strain limits... when ice and snow loads topple heavier lines.

An added factor in polyethylene wire's ability to stay up under adverse conditions is its smaller diameter. It offers less resistance to wind, a smaller surface for ice build-up.

Winning Combination

Called the "closest to the ideal covering for line wire," polyethylene is outstanding in other respects too. The shield it forms over wire is continuous...tough...resistant to aging, weathering, moisture, abrasion by lashing branches. It's good for decades of superior service marked by fewer outages, minimum maintenance.

When you order covered wire and cable, make sure the coating is made with PETROTHENE® polyethylene resins. PETROTHENE polyethylene costs no more, but it gives you premium weather and stress-crack resistance.

Polyethylene's advantages are outlined in an informative new U.S.I. data sheet, "Polyethylene...The Best Line Wire Covering." Also available is a data sheet showing properties, applications and specifications of PETROTHENE polyethylene compounds. Send for your copies today.

U. S. Industrial Chemicals Co.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.

Please send me:
☐ "Polyethylene...The Best Line Wire Covering"
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tary specifications. Another table lists minimum/maximum physical, mechanical, and electrical properties for the eight base laminates. General information on sheet sizes, thicknesses, tolerances, and weight and location of copper foil is included. Also tabulated are overload currents and resistances for printed circuits. Application engineering, research and development, sales, fabricating, and shipment scheduling services are described. 4 pages. Taylor Fibre Co., Norristown, Pa.
Print No. Ins. 209 on Reader Service Card

Silicone Rubber Data Sheet

New data sheet 9-406a lists typical properties of "Silastic" RTV 731, a general purpose, room temperature vulcanizing silicone rubber with electrical/electronic applications. Methods of application, cure time, bonding details, heat stability, and storage requirements are given. 2 pages. Dow Corning Corp., Midland, Mich.
Print No. Ins. 210 on Reader Service Card

Data Sheets on Urethane Foams For High Temperature Uses

Two new data sheets, CPP Nos. 13 and 14, describe urethane foam systems that are said to yield rigid foams dimensionally stable to 450°F (232°C) and to retain half their room temperature compressive strength at 600°F (316°C). CPP No. 14 details properties and applications of an infusible fast-acting foam system, while No. 13 covers an infusible slow foam (same heat-resistant properties, but long pot life). The Carwin Co., North Haven, Conn.
Print No. Ins. 211 on Reader Service Card

Insulation Catalog and Prices

New catalog 36 describes and gives prices on cuffed "Mylar"-paper combinations, "Varslot"-Mylar-paper insulation, creased separator coils, cuffed all rag paper, crimped paper transformer insulation, bulk packed cuffed insulation coils, assorted fibre washers, fabricated slot insulators, wedges, and slit coils. All necessary ordering information is listed. 20 pages. Publications Dept., Insulation Manufacturers Corp., 565 W. Washington Blvd., Chicago 6.
Print No. Ins. 212 on Reader Service Card

Brochure on High Temperature Electrical and Mechanical Tapes

New brochure provides information on properties of 10 pressure-sensitive "Teflon," fiber glass, and silicone rubber tapes for —100°F to 500°F (—73.3°C to 260°C) applications. It analyzes each tape individually as to construction, and recommends uses. Typical design features are also presented. 6 pages. The Connecticut Hard Rubber Co., Dept. TRT, New Haven, Conn.
Print No. Ins. 213 on Reader Service Card

Glass Reinforced Polyester Plastic Insulation Sample and Brochure

New brochure on fiber glass polyester sheet and molded parts for electrical insulation lists all important specification information for six grades of "Insulstruc" sheet. In addition, typical applications are pictured for both premix moldings and parts fabricated from flat sheet. The booklet also contains a small sample. pages. Cincinnati Development and Manufacturing Co., 5614 Wooster Pike, Cincinnati 27, Ohio.
Print No. Ins. 214 on Reader Service Card

Hexahydrophthalic Anhydride Bulletin

Booklet I-2R describes the characteristics and suggested uses for hexahydrophthalic anhydride and lists chemical and physical properties, physiological hazards, and handling procedures. Hexahydrophthalic anhydride is used in the manufacture of alkyd resins, coatings, adhesives, resins, and other products. 17 pages. Allied Chemical Corp., National Aniline Div., 40 Rector St., New York 6.
Print No. Ins. 215 on Reader Service Card

Bulletin Describes Flame-Proofing Of Urethane Foams

A technique for producing flame-resistant urethane foam of the polyether type is described in a new technical information bulletin. Research work with the flame-proofing agent, tris (beta-chloroethyl) phosphate (TCEP), reportedly reveals that the burning rate of polyether foams can be decreased appreciably by adding a small amount of TCEP to the foam mix, and the foam can be made completely self-extinguishing with the addition of higher propo

ionate amounts. Various technical data showing the effect of different amounts of TCEP on the flammability characteristics of foam based on a polypropylene ether triol are included in the new bulletin. Mobay Chemical Co., Pittsburgh 5, Pa.

Print No. Ins. 216 on Reader Service Card

Booklet on High Purity Gases

Properties, applications, and storage of ultra-high purity gases for insulating and many other applications are given in a new booklet, No. F-1002C. In addition to information about each gas, the booklet contains charts and graphs showing the results of extensive testing, including the areas of heat conductivity, excitation potentials, ionization coefficient, starting voltages, and discharge characteristics. 16 pages. Linde Co., Division of Union Carbide Corp., 270 Park Ave., New York 17.

Print No. Ins. 217 on Reader Service Card

Urethane Foam Facilities Brochure

Urethane foams for encapsulation of electronic components and many other uses are described in a new brochure. Prepolymers, mixing equipment, engineering service, and design assistance are discussed and illustrated. 8 pages. Isocyanate Products Inc., Wilmington 99, Del.

Print No. Ins. 218 on Reader Service Card

Pamphlet on How to Use "Teflon" Sheet, Rod, Tube, Tape, etc.

Illustrated pamphlet tells how to use and check quality of Teflon products in sheets, rods, tubes, tape, and other standard shapes. Electrical, chemical, physical, and thermal properties are given. Fabricating techniques using conventional equipment are discussed with recommendations on tools and cutting speeds. Suggestions are offered for uses in electrical equipment. 8 pages. Cadillac Plastic & Chemical Co., 15111 Second Ave., Detroit 2.

Print No. Ins. 219 on Reader Service Card

Reports on Polycarbonate Properties and Uses

New application report on polycarbonate mill shapes lists markets and uses with key properties for each application. 1 page. A new product bul-

letin describes electrical, chemical, thermal, and physical properties of polycarbonate, rod, plate, tubing, and sheeting; suggests applications; discusses machinability; and lists sizes. It also contains a chart of electrical, thermal, mechanical, and other properties, and a chemical resistance chart. 2 pages. The Polymer Corp. of Pennsylvania, Reading, Pa.

Print No. Ins. 220 on Reader Service Card

Bulletin on Isocyanate Storage and Handling

New guide to proper handling and storage requirements for isocyanates explains the best methods for unloading tank cars and tank trucks, handling drums, constructing storage tanks and transfer lines, cleaning storage tanks, and disposing of spillage. Recommendations on temperature and moisture control, health hazards, first aid, safety equipment, and ventilation are provided by bulletin C-3. 15 pages. Allied Chemical Corp., National Aniline Div., 40 Rector St., New York 6.

Print No. Ins. 221 on Reader Service Card

Brochure on Protective Compound For Insulators and Bushings

Brochure 4-218 explains and illustrates how Dow Corning 5 silicone compound applied to pole line insulators and electrical equipment bushings protects against excessive leakage, flashovers, and service interruptions in areas where atmospheres are contaminated by salt spray, industrial dust, or other air-borne particles. Details on function, applications, cleaning, and durability are included. 4 pages. Dow Corning Corp., Midland, Mich.

Print No. Ins. 222 on Reader Service Card

Environmental Test Chamber Bulletin

New technical bulletin describes "ValuMite" environmental test chambers for temperature testing, lists outstanding features, and gives technical specifications. 2 pages. International Radiant Corp., 577 E. 156th St., New York 55, N.Y.

Print No. Ins. 223 on Reader Service Card

Post-Forming Laminate Bulletin

Grade XX-7, a post-forming, phenolic resin laminated plastic which has a creped paper base, is described in technical data bulletin No 3.1.15. Recommended applications sheet sizes, thicknesses, color, an finish are given. Tables list physical mechanical, and electrical character istics. 2 pages. Taylor Fibre Co., Nor ristown, Pa.

Print No. Ins. 224 on Reader Service Card

Wire and Cable Insulation Quarterly

A new quarterly publication, "Wir and Cable Casebook," stresses actua case histories of specific types of wir and cable. The 1960 1st quarter issu discusses properties and application of neoprene cable jacketing. 4 page Casebook, Room N-2420, Elastome Chemical Dept., E. I. du Pont d Nemours & Co. Inc., Wilmington 98 Del.

Print No. Ins. 225 on Reader Service Card

Cable Splicing Manual and Movies

New illustrated bulletin 1134 cor tains step-by-step information on th splicing and terminating of bot shielded and unshielded rubber-nec prene cables. Tape selector and quan tity estimating charts, production in formation, and a purchase plannin aid sheet for tapes and splice kits ar also included. 30 pages. Two 16 m color films show preparation of th cable ends, installation of soldere connectors or compression lugs, an build-up of the splice. Print No. covers unshielded cables for use u to 5000 v and No. 2 covers th shielded variety for higher voltage 20 minutes each. (Bulletin sent o reader service request but writ direct for information on schedulin movies.) The Okonite Co., Publ Relations and Advertising Dept., Pa saic, N.J.

Print No. Ins. 226 on Reader Service Card

Self-Bonding Protective Nameplate Bulletin and Samples

New Poly-Plate self-bonding nam plate bulletin, No. 161-A, explains new type of nameplate that not on identifies the product, but also serv decorative, functional, and protecti purposes. The nameplates combine sub-surface printing and metalizin method with the protective qualiti of "Mylar" film (4000 vpm dielectri strength). Free samples. 4 page Write W. H. Brady Co., Dept. 16

27 West Glendale Ave., Milwaukee , Wis.

Print No. Ins. 227 on Reader Service Card

est Equipment Catalog

New short form #60 catalog shows xpanded line of high-voltage test ets, sensitive hipot testers, economy ne standard hipot testers, d-c over- otential testers, corona test sets, con- nuous production type insulation esters, wire sparkers, cable fault lo- ating sets, pinhole detector/counter, brasion-scrape tester for military ire, automatic test sets for cable test- ng, and high voltage rectifier units. eschel Electronics Inc., Patterson, utnam County, N.Y.

Print No. Ins. 228 on Reader Service Card

ooklet on Laminates, Boards, erminals, Plugs, Jacks, etc.

New booklet on standard and cus- om made electronic parts contains ypical electrical, physical, and chem- al values on paper, fabric, asbestos, lass, and nylon base grades of epoxy, henolic, and melamine laminated heets. Basic engineering data given ncludes base and resin type, specific haracteristics, company and NEMA rades, applicable government speci- cations, colors, thickness ranges, izes, weights, and cost factors. Fab- icated boards for printed circuits and erminal boards, custom fabricated arts, fuse mounting bases, terminal trips, and other components are de- cribed. Ordering information is in- luded. 36 pages. National Tel-Tronics Corp., 52 St. Casimir Ave., Yonkers, N.Y.

Print No. Ins. 229 on Reader Service Card

Manual on High Voltage Breakdown And Insulation Resistance Tests

New manual C-61 describes meth- ods and equipment for high voltage breakdown and insulation resistance tests to meet high reliability specifica- tions and extended environmental conditions. Equipment is shown for measuring to five million megohms. and for high voltage leakage tests at 150 kv and higher on electronic com- ponents, cables, wiring harnesses, completed assemblies, and control cir- cuits of all types. Associated Research Inc., 3777 W. Belmont Ave., Chicago 18.

Print No. Ins. 230 on Reader Service Card

Industry News

Hermetic Seal Corp., Nutley, N.J., has acquired *Connector Seals Corp.*, Pasadena, Cal. Wes Speers will continue as general manager of Connector Seals, and Don Allen will continue as sales manager.

The Madison, N.J., sales office of *Fostoria Corp.*, infrared oven manufacturer, has been relocated to Springfield, N.J.

Pressure-sensitive tapes can now be slit to requirements in a new custom slitting department established by *R. S. Hughes Co. Inc.*, Los Angeles.

Ling-Altec Electronics Inc., electronic manufacturer, has begun a $500,000 plant expansion and remodeling program for one of its Dallas subsidiaries, Continental Electronics Manufacturing Co., producer of super power transmission equipment for radar, sonar, and communications. The new two-story structure will add approximately 17,000 sq ft, making a total of 30,000 sq ft available for offices and engineering facilities. Plans are also being prepared to increase this to 100,000 sq ft later at a cost of $1,000,000.

Urethane Corp. of California, producer of urethane foam, has built and occupied a new plant at Compton, Calif.

The *Inorganic Chemicals Div.* of *Monsanto Chemical Co.*, St. Louis, which last year entered the electronic chemicals field with construction of a plant for the production of high purity silicon, has added indium arsenide and gallium arsenide to its line of semi-conductor materials.

Boonton Radio Corp., Boonton, N.J. electronic equipment manufacturer, is constructing a new 50,000

sq. ft. plant on a 70-acre site in Rockaway Township, N.J. Occupancy is scheduled for next spring.

Equipto Electronics Corp. has been formed in Naperville, Ill., for the manufacture of electronic racks and enclosures.

Foss Manufacturing Co., Twi Falls, Idaho, has been named sale representative in Idaho, Nevada Utah, and Wyoming for *Marblett Corp.*, Long Island City, N.Y., manu facturer of epoxy, polyurethane, an phenolic resins for electrical insula tion and other uses.

Taylor Fibre Co., Norristown, Pa vulcanized fibre and laminated pla tics manufacturer, plans to spen more than $500,000 in 1960 as pa of a four-year $2,000,000 capital e pansion and improvement program.

The Sterling Varnish Co. has an nounced that *Special Electric Co. Inc* Milwaukee, has joined with *Enginee ing Sales Co.*, also of Milwaukee, t represent Sterling throughout Wi consin.

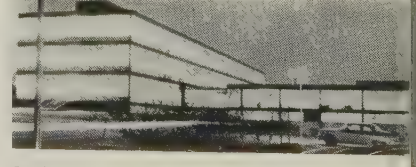
Essar Engineering Co., Chicag has been formed by S. G. Richard formerly of *Electrocraft Inc.*, manufacture custom built switch and similar equipment.

Stock and assets of the *Wind Tu bine Co.*, West Chester, Pa. man facturer of towers and antenna sy tems, have been sold by Robert W Weeks, former president, to a grou of nine associates.

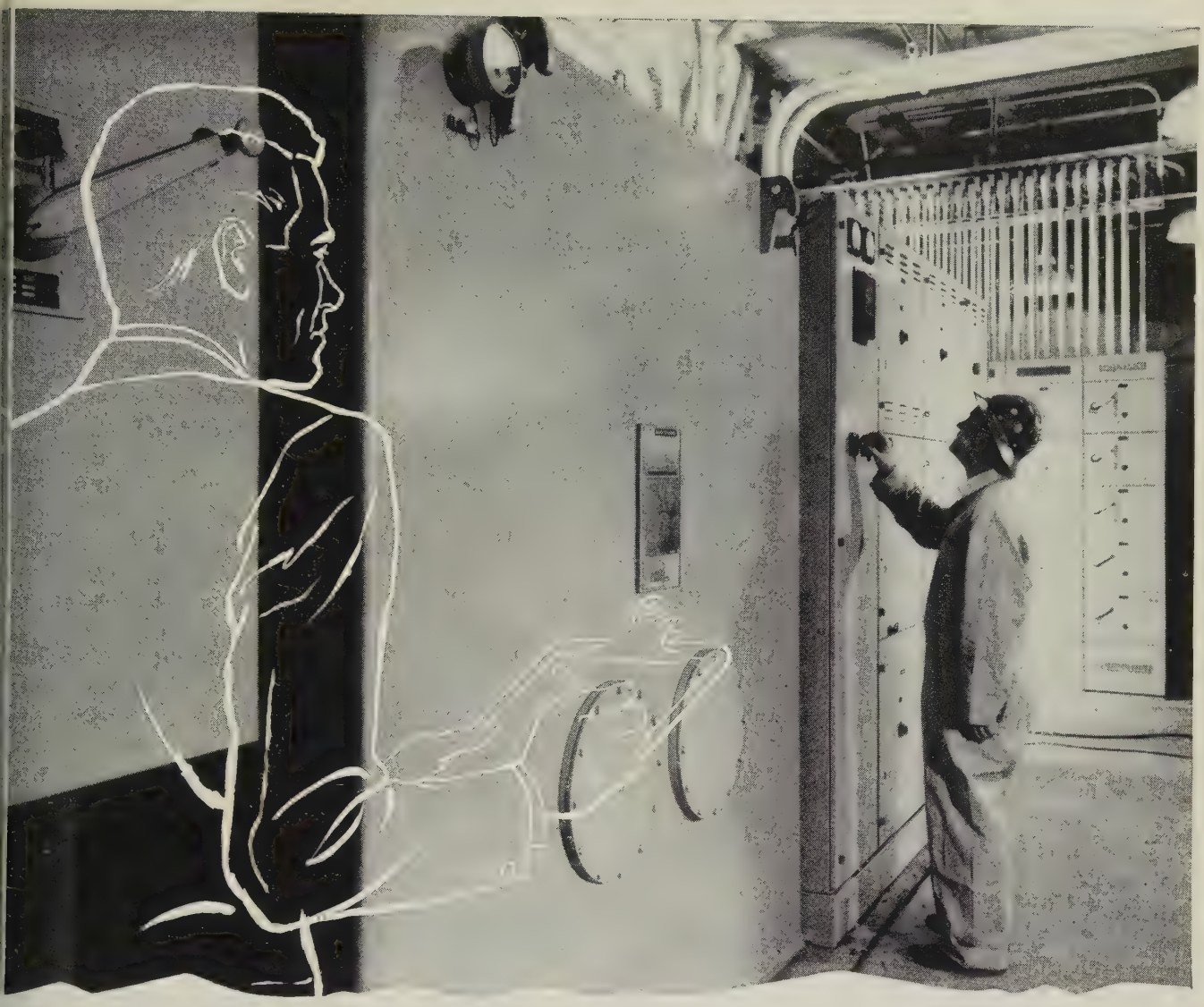
Standard Insulation Co. Inc., Ea Rutherford, N.J., has appointed *C. Waggoner Sales Co. Inc.*, Gra Prairie, Texas, and *D & O Enginee ing Co. Inc.*, Wichita, Kansas, to re resent Standard's line of pre-impre nated materials.

Stockholders of *Minnesota Mini & Manufacturing Co.*, St. Paul, ha approved a 3-for-1 split of the co pany's common stock.

Union Carbide Chemicals Co. now operating its new technical ser ice laboratory in Westchester, N. The building accommodates abo



100 scientists and is 300 ft. long a 60 ft. wide. The main portion is three-story stainless steel and gl building.



HOW THE SILICONES MAN HELPED BUILD A BIGGER SEALED, DRY TYPE TRANSFORMER

YEARS ago, after consulting the Silicones Man, a major manufacturer designed and built one of the first *big* Class H, sealed, *dry type* transformers. Nitrogen-filled, the unit had what was a phenomenal rating for dry types—*1000 KVA, with a temperature rise of 160°C*—transforming 4160 volts to 440 volts, three phase.

The insulation which made this possible was UNION CARBIDE R-620 Silicone Impregnating Varnish—today, a standard of the industry.

Now your Silicones Man continues to introduce more "firsts." For example, UNION CARBIDE XR-65 Silicone—a 100 per cent reactive resin—for Class H coils and electrical equipment. This new solventless resin cures in thick sections at temperatures as low as 125°C. Yet it meets AIEE 220°C. ratings, withstanding starting and surge loads involving temperatures up to 250°C.

If you have not yet investigated R-620 and XR-65 Silicone Varnishes for high temperature electrical applications, contact your Silicones Man for information. He has offices in many cities. Or write Dept. GI-6002, Silicones Division, Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. *In Canada:* Bakelite Division, Union Carbide Canada Limited, Toronto 7, Ontario.

Unlocking the secrets of silicones

Rubber, Monomers, Resins, Oils, Emulsions

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UNION CARBIDE **SILICONES**

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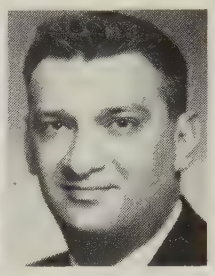
People in the News

Alpha Wire Corp., New York City, has elected *Howard B. Saltzman* as executive vice president, and *Jack Kirschbaum* as vice president in charge of sales. Saltzman, previously general manager, has been with Alpha for 12 years, while Kirschbaum, formerly general sales manager, has been with the company for five years.

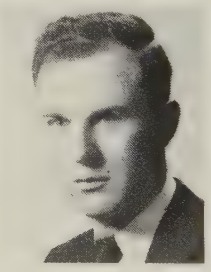
H. B. Saltzman



J. Kirschbaum

James M. Flounders has been appointed vice president in charge of research and development for the Boston Woven Hose and Rubber Div. of American Biltrite Rubber Co. Inc., Cambridge, Mass.

J. M. Flounders



M. P. Koerner

Mark P. Koerner, previously project manager of the Electrical Products Development Laboratory for Owens-Corning Fiberglas Corp., has joined Chase-Foster Inc., Providence, R.I., laminated electrical insulation producer, as technical director.

Woodrow W. Keisling, with the firm since 1959, has been appointed production superintendent of Moxness Products Inc., Racine, Wisc., producer of fluorocarbon and silicone rubber insulation products.

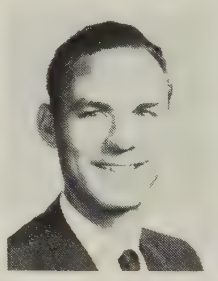
Bernard W. Eades has been appointed manager of value engineering for the Southwestern Industrial Electronics Co., a Div. of Dresser Industries Inc., Houston electronic instrumentation manufacturer.

M. C. Wakefield Jr. has been named sales manager of the Polyco Monomer Dept. of the Borden Chemical Co., New York City.

Peter L. Lindley, previously manager of special products section fo Electro-Data Corp., has been named manager of technical services fo Endevco Corp., Pasadena, Cal., electronic instrumentation firm.

Richard G. Hayes has been name to a newly created post of technica consultant on urethanes by the Day ton Industrial Products Co., Div. o Dayco Corp., Dayton. He previousl was associated with American Late Products Corp., a Div. of Dayco.

Earl R. Peterson has been ap pointed sales manager for the west ern division of Taylor Fibre Co., La Verne, Cal., vulcanized fibre an laminated plastics producer. He ha been with Taylor since 1953.



E. R. Peterson

R J. Noonan

Robert J. Noonan has been name production supervisor of the Elec tronics Div. of the American Tub Bending Co., New Haven, Conn.

Altec Lansing Corp., Anaheim Cal., has appointed *Alexis Badmaie* to chief engineer, acoustics-trans ducers, and *William H. Johnson* t manager of engineering and technica information dept. At the Peerles Electrical Products Div. of Alte Lansing, *Ercell B. Harrison* was pro moted to general manager and *Jame M. Farrell* was named plant manage

Clarence Mark Jr., previously vic president, has been elected to th newly created position of executiv vice president of Clayton Mark & Co Evanston, Ill., electrical conduit ma ufacturer.

Glen R. Pierce has been name manager of the newly created Di tributor Sales Div. of the Dearbor

hemical Co., Chicago electrical tape anufacturer.

Richard G. DiPaola, formerly with perry Gyroscope Co., has been appointed quality control manager of ational Semiconductor Corp., Danury, Conn., transistor manufacturer.

R. G. DiPaola

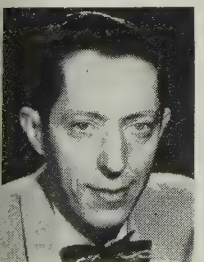
S. K. Towson Jr.

Sheldon K. Towson Jr., vice president of The Elwell-Parker Electric o., Cleveland, has also been elected eneral manager. The firm makes ectric powered industrial trucks.

I. W. Strong has been named manfacturers representative in Colorado, Wyoming, and Eastern Montana for he Thomas & Betts Co., Elizabeth, .J., electrical fittings manufacturer.

Clifford R. Smith, formerly with he Borden Chemical Co., has been amed to serve as a sales engineer in he Dayton, Ohio, office for F. J. tokes Corp., maker of plastic resses.

William H. Doty, former director f engineering for Electronic Specialties Co., has been named operaions manager for the Electronics Div., Elgin National Watch Co., Burank, Cal.



W. H. Doty

G. D. Maloney

George Donald Maloney, with the ompany since 1956, has been elected vice president in charge of manufacturing for the Portchester Instrument Corp., Port Chester, N.Y., electronic manufacturer.

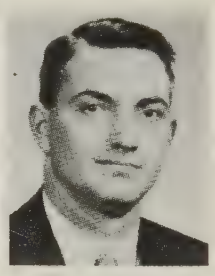
Robert H. Cottle, with the company ince 1950, has been named Los Angeles district manager for Formica

Corp., laminated plastics manufacturer.

In a previous issue it was announced that *W. H. Middendorf* had been named director of research for Cincinnati Development and Manufacturing Co. It should have been mentioned that Middendorf also retains his previous position as associate professor of electrical engineering at the University of Cincinnati.

At the Richardson Co., Melrose Park, Ill., laminated plastics manufacturer, *A. E. Wolfinger*, previously branch manager of the New York-New Jersey operations, has been named assistant sales manager, Plastics Div. *E. G. Whalen*, former field sales engineer, replaces Wolfinger. Another field sales engineer, *K. D. Rhoads*, has been appointed branch manager of the newly established Philadelphia branch office.

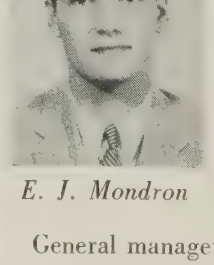
A. E. Wolfinger



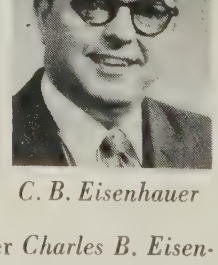
K. D. Rhoads

James L. Vincent, assistant treasurer since 1951, has been elected secretary and treasurer of the Anaconda Wire & Cable Co., New York.

Ernest J. Mondron, formerly an industrial engineer with Crosley Div., Avco Manufacturing Co., has been appointed to represent J. J. Glenn & Co., Chicago electrical insulation distributor, in the Southern Ohio territory.



E. J. Mondron



C. B. Eisenhauer

General manager *Charles B. Eisenhauer* has also been named vice president of the Electronics Div. of Van Norman Industries Inc., Manchester, N.H.

James L. von Harz, with the company since 1941 and most recently vice president, manufacturing, has been elected executive vice president, operations, Oak Manufacturing Co., Chicago component parts manufacturer for the electronics and electrical industries.

At Waltham, Mass., *James H. Brewster III* has been appointed vice president, operations of Sylvania Electronic Systems, a Div. of Sylvania Electric Products Inc. At Williamsville, N.Y., *Howard S. Moncton* has been named manager of planning and review for the Amherst Laboratory, a facility of the Buffalo operations of Sylvania Electronic Systems. At Batavia, N.Y., *O. John Hayles* has been appointed general manufacturing manager of Sylvania Home Electronics, another division, to succeed *Harry H. Martin*, who has been promoted to corporate director of purchases in New York City. At Woburn, Mass., *J. Robert Henderson* has been named to the newly created position of manager of packaging engineering for the Semiconductor Div.

Leo Adams, formerly chief project engineer at Standard Packaging Corp., has been appointed production superintendent of the Electro-Technical Products Div., Sun Chemical Corp., Nutley, N.J., electrical insulation manufacturer.

Maurice Winger Jr. has been appointed general manager of the William Brand-Rex Div. of American Enka Corp., Concord, Mass. manufacturer of wire, cable, flexible tubing, extrusions, and cast plastics for ultra-high frequency applications. He previously was corporate secretary and assistant to the president.

Maurice Winger

Melvin Landau

ESC Corp., Palisades Park, N.J. electronic component manufacturer has appointed *Melvin Landau* as chief mechanical engineer.

Irving B. Polhemus, general manager since 1958, has been elected vice president of Acme Resin Corp., Forest Park, Ill., manufacturer of diallyl phthalate insulation materials.

In the fiber glass division of Pittsburgh Plate Glass Co., Pittsburgh, Pa., *P. Dudley Kaley*, formerly manager of sales and with the company since 1952, has been named director of marketing and sales. *A. W. Stevenson*, previously New York City district sales manager, succeeds Kaley as manager of sales, while *Orville Miller Jr.*, who had served as manager of superfine products, has been appointed manager of marketing.

Dr. Stewart S. Flaschen, formerly staff scientist, has been promoted to manager of research and advanced development for the Semiconductor Products Div. of Motorola Inc., Phoenix.

At Consolidated Electrodynamics Corp., Pasadena, Calif., *Robert H. Carretson* has been appointed executive vice president, a newly created post. He joined CEC in 1959 as a group vice president. *Donald W. Cook*, previously assistant director of the Analytical & Control Div., has been named director of the Transducer Div. *T. Phillips Morgan* has been named director of operations of Consolidated Systems Corp., a subsidiary at Monrovia, Calif.

Ronald E. Cunningham has been appointed director of sales for Anaheite Inc., South Gate, Calif., producer of anodized aluminum for electronic components and other products.

R. E. Cunningham

R. E. Caplan

Richard E. Caplan, previously assistant to the technical director, has been named supervisor, product development laboratories, for Midland Industrial Finishes Co., Waukegan, Ill., high temperature coating manufacturer.

The Chemical Materials Dept. of General Electric Co. in Pittsfield, Mass., has named *Harold Jacoby*, technical service engineer, while *Henry J. Singer* has joined the department as a sales trainee.

Eugene R. Perry, president, National Vulcanized Fibre Co., Wilmington, is shown (on the left) receiving the first annual management award for the advancement of management from *J. H. Tyler McConnell* of the Hercules Powder Co. Perry was honored for his significant contributions toward the advancement of management and for his contributions in professional, civic, and community affairs.

Vernon E. Moore has been promoted to Midwest district manager for Becco Chemical Div. of Food Machinery and Chemical Corp., Buffalo, N.Y. chemical manufacturer for the electronic and other industries.

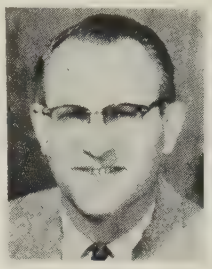
James P. Kneubuhl, previously a vice president with the Fluor Corp., Ltd., Los Angeles, has been elected president of Research-Cottrell Inc., Bound Brook, N.J. manufacturer of electrical precipitators.

At Hoover Electronics Co., Timonium, Md., *Carl A. Hultberg*, formerly an engineering group leader at Bell Aircraft Corp., has been named senior project engineer. *Murray W. Lindenthal*, formerly with the Martin Co., has been appointed senior electronics engineer and *Ernest A. Laufer*, previously with Bell Aircraft Corp., has also been named senior electronics engineer.

Howard A. Smith has been appointed national sales manager by Emerson & Cuming Inc., Canton, Mass.

James T. Simmons, with the company since 1959 as Ossining Div. plant manager, has been appointed general manager of the Ossining Div., Hudson Wire Co., Ossining, N.Y. Also at Ossining, *J. V. DeMattei* has been named division manager of materials, *Bryan J. MacDonald* has been appointed division controller, and *Donald E. Thomas* has been named division manager of engineering.

Herb C. Golz, formerly general manager and chief engineer of Elgin Metalformers Corp., has been named president of Equipto Electronics Corp., Naperville, Ill. *Lawrence J. Fay*, previously chief design engineer with the Elgin Co., has been named chief engineer of Equipto.



H. C. Golz

L. J. Fay

S. C. Bielawski, with the company since 1936 and most recently assistant to the West Allis Works purchasing agent, has been named West Allis Works purchasing agent, industries group, Allis-Chalmers Manufacturing Co., Milwaukee.

Murray Neipris has been named plant superintendent for The Blane Corp., Canton, Mass., manufacturer of vinyl and polyethylene compounds and color concentrates. With the company since 1953, he had previously been assistant to the chief chemist.

Murray Neipris

C. R. Pickens

Cecil R. Pickens has been named insulated products sales manager of the Electrical Conductor Div., Kaiser Aluminum & Chemical Sales Inc., Oakland, Calif. He had been division technical manager at the Newark, Ohio, wire and cable works.

At Riegel Paper Corp., New York City, *William M. Riegel*, with the company since 1950, has been promoted to manager of merchant and industrial sales for the Specialty Products Div. *Wilson W. Cross*, who joined the firm in 1951, has been promoted to product manager for the Specialty Products Div., while *John B. Nunez* has been advanced to product manager for merchant and technical papers, and *Jerre W. Hoffman* has been named product supervisor, merchant and technical papers.

Dates to Circle

Meeting and Convention Notices

Aug. 8-12 . . . AIEE, Pacific General Meeting, El Cortez Hotel, San Diego, Cal.

Aug. 18-19 . . . Electronic Packaging Symposium, University of Colorado, Boulder, Colo.

Aug. 23-26 . . . WESCON, Ambassador Hotel and Los Angeles Memorial Sports Arena, Los Angeles, Cal.

Sept. 7-8 . . . EIA, Second Conference on Value Engineering, Disneyland Hotel, Anaheim, Cal.

Sept. 7-9 . . . IRE, Joint Automatic Control Conference, MIT, Cambridge, Mass.

Sept. 13-16 . . . EIA, Fall Conference, French Lick, Ind.

Sept. 14-16 . . . AIEE-ASME, Engineering Management Conference, Morrison Hotel, Chicago.

Sept. 15-17 . . . EIA, Upper Midwest Electronic Conference, Minneapolis, Minn.

Sept. 19-22 . . . IRE, Space Electronics and Telemetry Convention and Symposium, Shoreham Hotel, Washington, D.C.

Sept. 21-22 . . . IRE, Industrial Elect. Symposium, Sheraton Cleveland Hotel, Cleveland, Ohio.

Sept. 21-23 . . . AIEE-ASME, National Power Conference, Bellevue-Stratford Hotel, Philadelphia, Pa.

Sept. 23-Oct. 1 . . . English Domestic Electrical Apparatus Exhibition, Electrical Fairs Ltd., Alexandra Palace, London.

Sept. 26-28 . . . Standards Engineers Society, 9th National Convention, Pittsburgh Hilton Hotel, Pittsburgh, Pa.

Sept. 26-29 . . . American Welding Society, National Fall Meeting, Hotel Penn-Sheraton, Pittsburgh, Pa.

Sept. 28-30 (Tentative) . . . Canadian Electrical Manufacturers Assn., 16th Annual Meeting, Sheraton Brock Hotel, Niagara Falls, Canada.

Oct. 3-5 . . . IRE, Sixth National Communications Symposium, Hotel Utica and Utica Memorial Auditorium, Utica, N.Y.

Oct. 3-7 . . . 21st Southern Textile Exposition, Textile Hall Corp., Textile Hall, Greenville, S.C.

Oct. 9-13 . . . Electrochemical Society Meeting, Shamrock Hotel, Houston, Tex.

Oct. 9-14 . . . AIEE, Fall General Meeting, Morrison Hotel, Chicago.

Oct. 10-12 . . . National Electronics Conference, sponsored by AIEE, IRE, and Illinois Institute of Technology, Hotel Sherman, Chicago.

Oct. 13-14 . . . SPI, 16th Annual New England Section Conference, Wentworth-by-the-Sea, Portsmouth, N.H.

Oct. 17-19 . . . Conference on Electrical Insulation, National Research Council—National Academy of Sciences, National Bureau of Standards and Shoreham Hotel, Washington, D.C.

Oct. 19-21 . . . IRE, Symposium on Space Navigation, Deshler-Hilton Hotel, Columbus, Ohio.

Oct. 24-26 . . . IRE, East Coast Conference on Aeronautics and Navigational Electronics, Baltimore, Md.

Oct. 27-29 . . . IRE, Electron Devices Meeting, Hotel Shoreham, Washington, D.C.

Oct. 31-Nov. 2 . . . IRE, Radio Fall Meeting, Hotel Syracuse, Syracuse, N.Y.

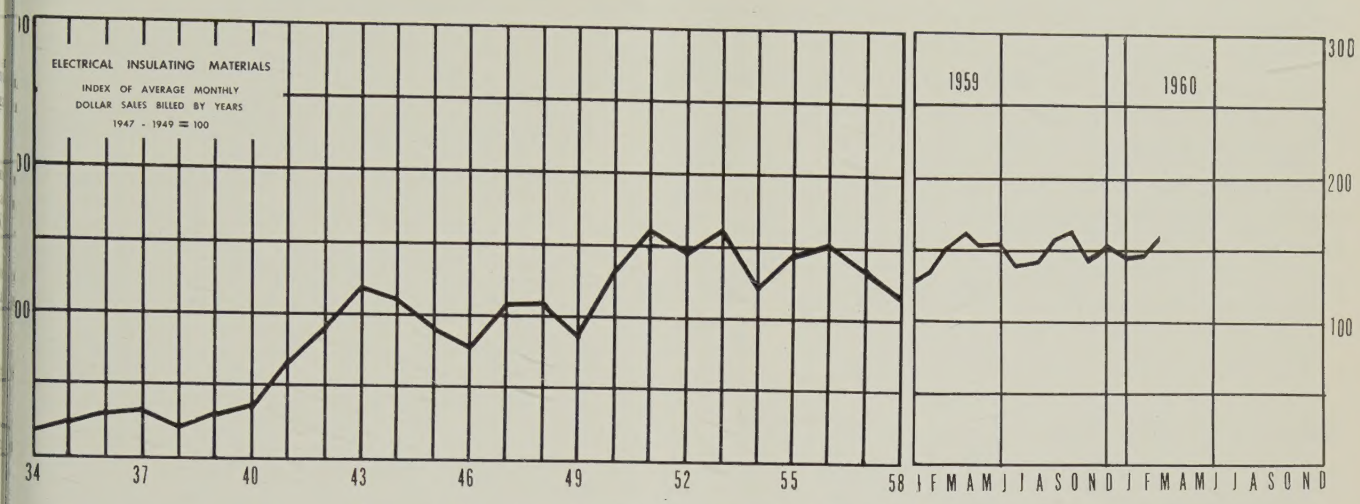
Oct. 31-Nov. 4 . . . IEC, General Meeting, New Delhi, India.

Dec. 5-8 . . . Third National Conference on the Application of Electrical Insulation, Conrad Hilton Hotel, Chicago.

Abbreviations Used in Notices

AIEE	—American Institute of Electrical Engineers	NEMA	—National Electrical Manufacturers Assn.
ASTM	—American Society for Testing Materials	NISA	—National Industrial Service Assn.
ASME	American Society of Mechanical Engineers	SPE	—Society of Plastics Engineers
ASA	—American Standards Assn.	SPI	—Society of the Plastics Industry
IRE	—Institute of Radio Engineers	WEMA	—Western Electronic Manufacturers Assn.
EIA	—Electronic Industries Assn.		

NEMA Electrical Insulation Index



	Mar. '60	Feb. '60	Mar. '59
ndex series	168	149	152
Mar. '60 point change from other mos.		+19	+16
Mar. '60 % change from other months		+13	+11

ndex is based on 1947-1949 average month, inclusive= 100

Published through the courtesy of the National Electrical Manufacturers Association

Materials Used in Electrical Insulation Index

Industrial Laminated Products

Manufactured Electrical Mica

Varnished Fabric and Paper

Vulcanized Fibre

Varnished Tubing and Saturated Sleeving (From May. 1952)

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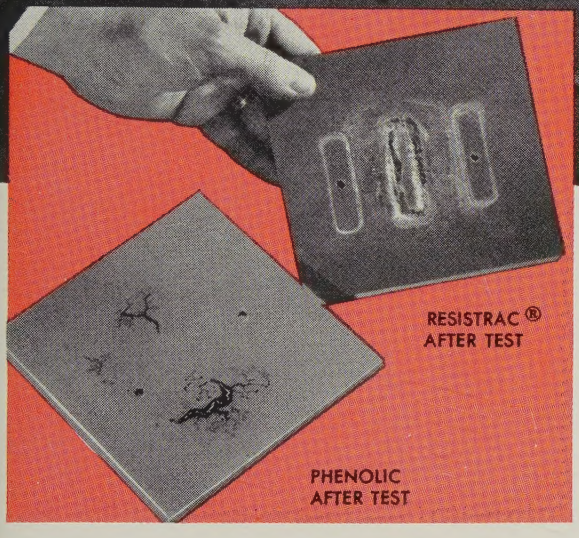


ABOVE: 10-sec. time exposure shows insulating material subjected to ASTM suggested dust & fog test. 1500 volts applied between electrodes causes arcing on the moist, contaminated surface.

LEFT: Samples of molding materials after test. Phenolic tracked to ground in 27 min. RESISTRAC is eroded after 648 hrs. but exhibits no carbon tracking.

New GLASTIC RESISTRAC

This fiber glass reinforced alumina-polyester combines resistance to carbon treeing and dimensional stability approaching that of ceramics, and the toughness and precision of plastics. RESISTRAC offers the designer a material free from the tracking limitations of thermosetting plastics and without the shortcomings of ceramics.

Consider this excellent *combination* of properties:

Outstanding Track Resistance—50 times the tracking resistance of conventional fiber glass polyester premix. 1000 times the tracking resistance of phenolics.

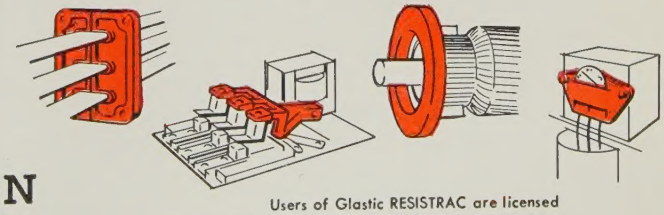
Flashover Resistance—Unlike ceramics, it gives shatter proof performance under the thermal shock of power flashover.

Chipping Resistance—From 3 to 6 foot pounds Izod impact strength compared with .05 to 1.0 foot pounds for most ceramics.

Flame Resistance—Completely self extinguishing. 90 sec. ign., 30 sec. ext. (Fed. Spec. LP 406b).

These design advantages plus heat resistance, low moisture absorption, and excellent moldability can offer real product improvement in apparatus where carbon tracking is a danger. And full design utilization of the properties can result in significant cost savings.

RESISTRAC is available in molded parts and in sheet stock. Write for engineering data.



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Users of Glastic RESISTRAC are licensed for its application as covered in U.S. Patent 2,768,264.

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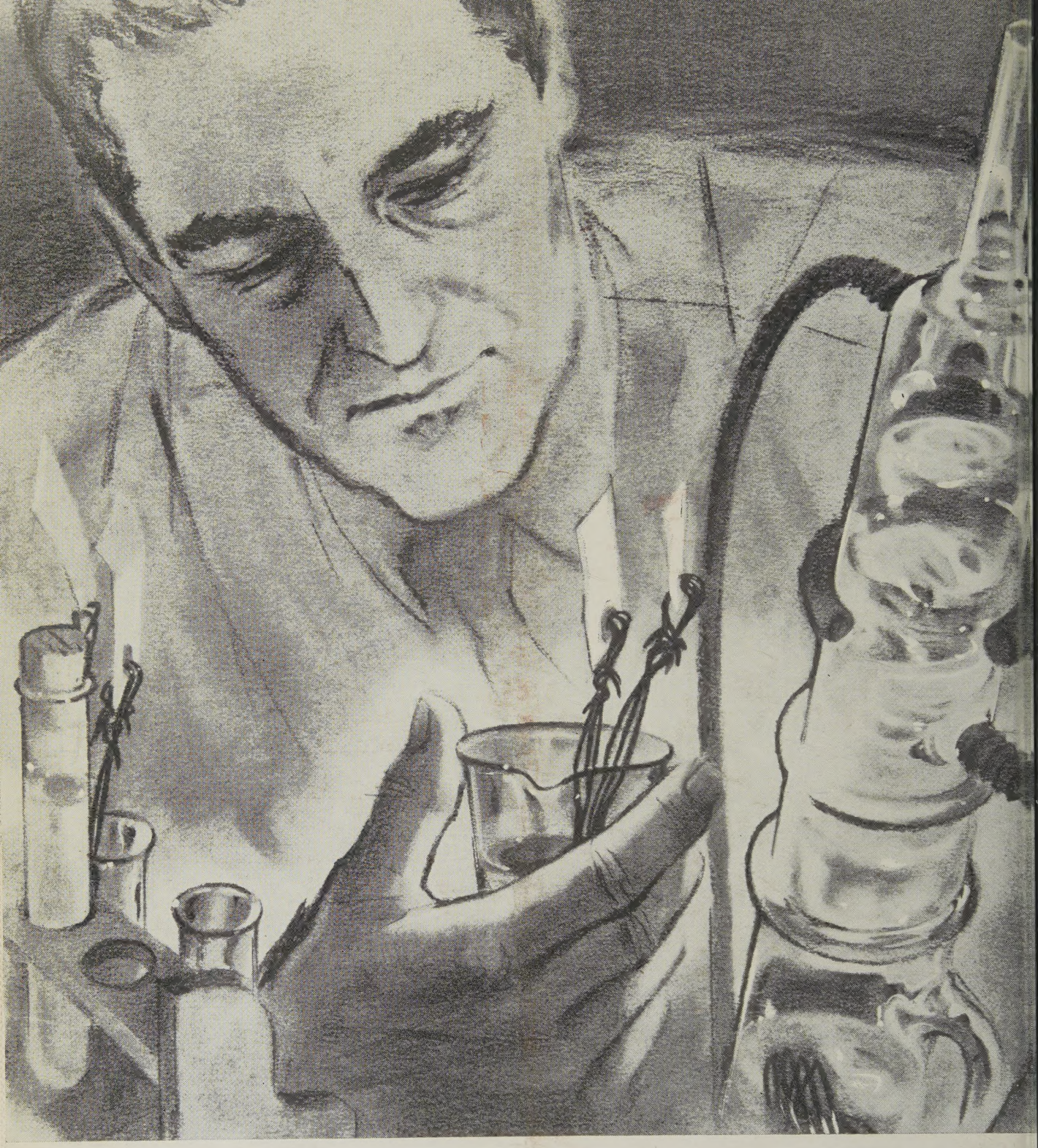

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This is just one more way that Rea Research helps customers new and better operating characteristics of their electrical produc

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